

S.N. 10/675078

5. The method of conducting a water gas shift reaction comprising contacting a gas comprising a mixture of hydrogen, carbon monoxide and water vapor at a temperature of about 200° to 550°C in contact with a catalyst said catalyst comprising molybdenum carbide.

6. The method claimed in claim 5 wherein said molybdenum carbide has a surface area greater than $35 \text{ m}^2/\text{g}$.

=> file reg

FILE 'REGISTRY' ENTERED AT 13:26:16 ON 26 MAR 2004
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=> display history full l1-

L1 FILE 'REGISTRY' ENTERED AT 12:55:58 ON 26 MAR 2004
137 SEA (MO(L)C)/ELS (L) 2/ELC.SUB

L2 FILE 'HCA' ENTERED AT 13:00:54 ON 26 MAR 2004
42745 SEA WATERGAS## OR (WATER# OR H2O) (2A)GAS##
L3 5930 SEA L1 OR (MOLYBDENUM# OR MO) (W)CARBIDE# OR MOC OR MO2C
L4 15 SEA L2 AND L3
L5 5674 SEA SHIFT# (2A) (REACT? OR RX# OR RXN#)
L6 12 SEA L5 AND L3
L7 12 SEA L2 AND L6
L8 15 SEA L4 OR L6
L9 6498 SEA FISCHER# (2A)TROPSCH#
L10 10740 SEA (FUELGAS## OR FUEL? (2A)GAS## OR HYDROCARBON? OR
METHANE# OR (NATURAL OR NAT#) (2A)GAS## OR CH4) (3A)REFORM?
L11 3599 SEA METHANAT?
L12 66 SEA (L9 OR L10 OR L11) AND L3

FILE 'REGISTRY' ENTERED AT 13:09:14 ON 26 MAR 2004
E HYDROGEN/CN
L13 1 SEA HYDROGEN/CN
E CARBON MONOXIDE/CN
L14 1 SEA "CARBON MONOXIDE"/CN

FILE 'HCA' ENTERED AT 13:13:35 ON 26 MAR 2004
L15 543512 SEA L13 OR H2 OR (HYDROGEN# OR H) (2A) (GAS## OR GASEOUS?
OR GASIF? OR ATMOS? OR ATM# OR STREAM? OR FLOW# OR
FLOWED OR FLOWING# OR NOZZL? OR JET OR JETS OR PORT# OR
PORTAL? OR TREAT? OR PRETREAT? OR APPLICATION? OR APPLY?
OR APPLIED OR PROCESS? OR SYRING? OR INJECT? OR INTRODUC?
)
L16 172465 SEA L14 OR CARBON# (A) MONOXIDE# OR CO (2A) (GAS## OR
GASEOUS? OR GASIF? OR ATMOS? OR ATM# OR STREAM? OR FLOW#
OR FLOWED OR FLOWING# OR NOZZL? OR JET OR JETS OR PORT#
OR PORTAL? OR TREAT? OR PRETREAT? OR APPLICATION? OR
APPLY? OR APPLIED OR PROCESS? OR SYRING? OR INJECT? OR
INTRODUC?)
L17 321959 SEA STEAM# OR (WATER# OR H2O) (2A) (VAPOR? OR VAPOUR? OR
EVAP? OR GAS## OR GASIF? OR GASEOUS? OR VOLATIL? OR

ATOMIZ? OR ATOMIS?)

| | | |
|-----|------|--|
| L18 | 107 | SEA (DIMOLYBDENUM# OR DI(A)MO) (W)CARBIDE# |
| L19 | 1 | SEA (L2 OR L5) AND L18 |
| L20 | 14 | SEA (L3 OR L19) AND L9 |
| L21 | 39 | SEA (L3 OR L19) AND L10 |
| L22 | 15 | SEA (L3 OR L19) AND L11 |
| L23 | 9539 | SEA L17 AND REFORM? |
| L24 | 15 | SEA L23 AND (L3 OR L19) |
| L25 | 7172 | SEA L15 AND L16 AND L17 |
| L26 | 7 | SEA L25 AND (L3 OR L19) |
| L27 | 25 | SEA L4 OR L6 OR L19 OR L24 OR L26 |
| L28 | 22 | SEA (L20 OR L22) NOT L27 |
| L29 | 27 | SEA L21 NOT (L27 OR L28) |
| L30 | 0 | SEA L12 NOT (L27 OR L28 OR L29) |

=> file hca

FILE 'HCA' ENTERED AT 13:26:27 ON 26 MAR 2004

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=> d 127 1-25 cbib abs hitstr hitind

L27 ANSWER 1 OF 25 HCA COPYRIGHT 2004 ACS on STN

140:29374 Oxidation stability of **Mo2C** catalysts under fuel **reforming** conditions. Darujati, Anna R. S.; LaMont, David C.; Thomson, William J. (Department of Chemical Engineering, Washington State University, Pullman, WA, 99164-2710, USA). Applied Catalysis, A: General, 253(2), 397-407 (English) 2003. CODEN: ACAGE4. ISSN: 0926-860X. Publisher: Elsevier Science B.V..

AB The oxidn. stability of a low surface area **Mo2C** catalyst has been studied in the presence of gases assocd. with the **steam** and dry (CO2) **reforming** of methane, at temps. up to 850°C and pressures to 8 bar. The oxidn. onset temps. were found to be about 600°C when the carbide was exposed to either **steam** or CO2. There appears to be two distinct mechanisms for **Mo2C** oxidn.: direct oxidn. at temps. below 750°C and thermal decompn. followed by oxidn. of the Mo metal at temps. above 750°C. Although onset temps. were similar, CO2 was a stronger oxidant than **steam** at the higher temps. Both **H2** and CO were found to inhibit oxidn. and the effect can be explained by their influence on the reactions governing carburization and oxidn. The **water gas shift reaction** readily occurred over the catalyst and it was found that a carburizing ratio, defined as the ratio of carburizing gases to oxidizing gases, was able to predict stability,

with oxidn. occurring at ratios of 0.8 or lower. The effect of pressure on the onset temp. of CO₂ oxidn. of the carbide was found to be negligible, even when inhibited by CO.

IT 630-08-0P, Carbon monoxide, uses
1333-74-0P, Hydrogen, uses
(oxidn. stability of Mo₂C catalysts under fuel
reforming conditions)
RN 630-08-0 HCA
CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

$\text{C}\equiv\text{O}^+$

RN 1333-74-0 HCA
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

CC 52-1 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 49, 51
ST carbon dioxide methane **reforming** catalyst
molybdenum carbide oxidn stability
IT Fuel cells
(hydrogen prodn. for; oxidn. stability of Mo₂C
catalysts under fuel **reforming** conditions in relation
to)
IT Oxidation
Reforming catalysts
Steam reforming catalysts
Synthesis gas manufacturing
(oxidn. stability of Mo₂C catalysts under fuel
reforming conditions)
IT 124-38-9, Carbon dioxide, reactions
(methane **reforming** with; oxidn. stability of
Mo₂C catalysts under fuel **reforming** conditions)
IT 630-08-0P, Carbon monoxide, uses
1333-74-0P, Hydrogen, uses
(oxidn. stability of Mo₂C catalysts under fuel
reforming conditions)
IT 12627-57-5, **Molybdenum carbide**
(oxidn. stability of Mo₂C catalysts under fuel
reforming conditions)
IT 74-82-8, Methane, reactions
(oxidn. stability of Mo₂C catalysts under fuel
reforming conditions)

L27 ANSWER 2 OF 25 HCA COPYRIGHT 2004 ACS on STN

- 139:294165 Carbon monoxide hydrogenation over molybdenum and tungsten carbides. Patterson, Patricia M.; Das, Tapan K.; Davis, Burtron H. (Center for Applied Energy Research, University of Kentucky, Lexington, KY, 40511, USA). Applied Catalysis, A: General, 251(2), 449-455 (English) 2003. CODEN: ACAGE4. ISSN: 0926-860X. Publisher: Elsevier Science B.V..
- AB Hydrogenation of carbon monoxide was studied over the fcc. phases of molybdenum and tungsten carbides. Moderately high surface area unsupported molybdenum and tungsten carbides (95 and 52 m² g⁻¹, resp.) were prepd. using a temp. programmed synthesis method. The starting oxides were first converted to a cubic nitride by reacting with ammonia, which are subsequently transformed to the carbide in a methane/hydrogen mixt. The presence of the fcc. structure was confirmed by X-ray diffraction. The catalysts were tested in a slurry continuously stirred tank reactor (CSTR) at P=2 MPa, in the temp. range 494-573 K and space velocities that varied from 2.5 to 15 S l h⁻¹ g⁻¹cat. The prodn. of large amts. of carbon dioxide instead of water in the case of **molybdenum carbide** indicates a high **water gas** shift activity. In both cases the main hydrocarbon product is methane.
- CC 51-4 (Fossil Fuels, Derivatives, and Related Products)
- ST Fischer Tropsch reaction molybdenum tungsten carbide; **water gas shift reaction** molybdenum tungsten carbide; carbon monoxide hydrogenation molybdenum tungsten carbide; hydrogenation carbon monoxide molybdenum tungsten carbide; **molybdenum carbide** hydrogenation carbon monoxide; tungsten carbide hydrogenation carbon monoxide
- IT Hydrogenation catalysts
 Water gas shift reaction
 (carbon monoxide hydrogenation over molybdenum and tungsten carbides)
- IT 12070-12-1P, Tungsten carbide 12627-57-5P, **Molybdenum carbide**
 (prepn. and catalytic activity of high surface area cubic molybdenum and tungsten carbides for Fischer-Tropsch reaction in high pressure continuously stirred tank reactor)
- L27 ANSWER 3 OF 25 HCA COPYRIGHT 2004 ACS on STN
- 138:356004 Preparation of novel Mo-W catalyst for **steam reforming** of methane to produce fuel gas. Tan, Yueming; Wu, Xuefei (Peop. Rep. China). Faming Zhuanli Shenqing Gongkai Shuomingshu CN 1362282 A 20020807, 8 pp. (Chinese). CODEN: CNXXEV. APPLICATION: CN 2002-100061 20020114.
- AB The catalyst is composed of **MoC** 0.5-2, WC 1-3, and a porous carrier 0.5-4 wt. parts. The catalyst is prepd. by impregnating the carrier with aq. soln. of Mo and W salts, drying at 100-110° for 10-12 h, activating at 500-550° for 12-15 h, carbonizing at 700-1200°, and passivating. The catalyst

is highly durable and effective for **steam reforming** of CH₄ to produce H₂-rich fuel gases.

IC ICM B01J023-30

CC 51-9 (Fossil Fuels, Derivatives, and Related Products)

Section cross-reference(s): 67

ST methane **steam reforming** molybdenum tungsten catalyst prepn

IT Fuel gas manufacturing

Petroleum **reforming** catalysts

(**steam reforming**; prepn. of novel Mo-W catalyst for **steam reforming** of methane to produce fuel gas)

IT 12070-12-1, Tungsten carbide 12627-57-5, **Molybdenum carbide**

(prepn. of novel Mo-W catalyst for **steam reforming** of methane to produce fuel gas)

IT 11098-84-3, Ammonium molybdate 11140-77-5, Ammonium tungstate

(prepn. of novel Mo-W catalyst for **steam reforming** of methane to produce fuel gas)

L27 ANSWER 4 OF 25 HCA COPYRIGHT 2004 ACS on STN

138:290269 The stability of **molybdenum carbide**

catalysts in methane **reforming**. LaMont, David C.;

Darujati, Anna R. S.; Gallaher, Benjamin N.; Thomson, William J. (Department of Chemical Engineering, Washington State University, Pullman, WA, 99164-2710, USA). Preprints of Symposia - American Chemical Society, Division of Fuel Chemistry, 48(1), 324 (English) 2003. CODEN: PSADFZ. ISSN: 1521-4648. Publisher: American Chemical Society, Division of Fuel Chemistry.

AB A **Mo₂C** catalyst was used in the **steam**

reforming reaction of methane over a period of 100 h. The oxidn. of the catalyst was monitored by XRD measurements, and the influence of S-compds. on the activity of these catalysts was evaluated. By poisoning of the catalyst with 1000 ppm di-Me sulfide in the feed the **steam reforming** activity dropped to 45-65%, but the catalyst could be regenerated under S-free conditions.

IT 12069-89-5, **Molybdenum carbide** (**Mo₂C**)

(stability of **molybdenum carbide** catalysts in methane **steam reforming**)

RN 12069-89-5 HCA

CN **Molybdenum carbide** (**Mo₂C**) (8CI, 9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CC 52-1 (Electrochemical, Radiational, and Thermal Energy Technology)

Section cross-reference(s): 51, 67

ST **molybdenum carbide** catalyst **steam reforming** methane

- IT Poisoning, catalytic
(by di-Me sulfide; stability of **molybdenum carbide** catalysts in methane **steam reforming**)
- IT **Steam reforming** catalysts
(stability of **molybdenum carbide** catalysts in methane **steam reforming**)
- IT Fuel gas manufacturing
(**steam reforming**; stability of **molybdenum carbide** catalysts in methane **steam reforming**)
- IT 75-18-3, Dimethyl sulfide
(poisoning by; stability of **molybdenum carbide** catalysts in methane **steam reforming**)
- IT 12069-89-5, **Molybdenum carbide** (**Mo2C**)
(stability of **molybdenum carbide** catalysts in methane **steam reforming**)
- IT 74-82-8, Methane, reactions
(stability of **molybdenum carbide** catalysts in methane **steam reforming**)

L27 ANSWER 5 OF 25 HCA COPYRIGHT 2004 ACS on STN

137:265343 High-surface-area **molybdenum carbide** as catalyst for **water gas shift**

reaction and for dry CO2 **reforming** of methane.

Seegopaul, Purnesh; Gao, Lin (N.V. Umicore S.A., Belg.). PCT Int. Appl. WO 2002076885 A2 20021003, 13 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR. (English). CODEN: PIXXD2. APPLICATION: WO 2002-EP3339 20020322. PRIORITY: US 2001-817523 20010326.

- AB A high-surface-area **molybdenum carbide** (**Mo2C**) is prepd. by heat soaking a molybdenum oxide or a molybdate in **H2-CO gas** at 300-400° for 1-5 h followed by heat soaking the product in a **H2-CH4** mixt. at 550-850° for 3-5 h. The product **Mo2C** (with nominal compn. Mo2C0.95-1.05) is a metastable, nanograined solid with a high surface area (>35 m2/g), and is active for the **water gas shift reaction** and dry (CO2) **reforming** of CH4 to synthesis gas.

IT 329722-20-5, Molybdenum carbide
 (Mo₂C_{0.95-1.05})
 (carbiding of; high-surface-area molybdenum
 carbide as catalyst for water gas
 shift reaction and for dry CO₂
 reforming of methane)
 RN 329722-20-5 HCA
 CN Molybdenum carbide (Mo₂C_{0.95-1.05}) (9CI) (CA INDEX NAME)

| Component | Ratio | Component Registry Number |
|-----------|-------------|------------------------------|
| C | 0.95 - 1.05 | 7440-44-0 |
| Mo | 2 | 7439-98-7 |

IT 12069-89-5, Molybdenum carbide (
 Mo₂C)
 (high-surface-area molybdenum carbide as
 catalyst for water gas shift
 reaction and for dry CO₂ reforming of methane)
 RN 12069-89-5 HCA
 CN Molybdenum carbide (Mo₂C) (8CI, 9CI) (CA INDEX NAME)
 *** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
 IC ICM C01B003-40
 ICS C01B003-16; B01J027-22
 CC 51-5 (Fossil Fuels, Derivatives, and Related Products)
 ST molybdenum carbide carbon dioxide
 reforming methane; water gas shift
 molybdenum carbide catalyst; synthesis gas
 carbiding molybdenum carbide catalyst prepn
 IT Water gas shift reaction
 catalysts
 (high-surface-area molybdenum carbide as
 catalyst for water gas shift
 reaction and for dry CO₂ reforming of methane)
 IT Fuel gas manufacturing
 (reforming, dry reforming, of methane;
 high-surface-area molybdenum carbide as
 catalyst for water gas shift
 reaction and for dry CO₂ reforming of methane)
 IT 74-82-8, Methane, uses
 (carbiding agent and dry reforming of;
 high-surface-area molybdenum carbide as
 catalyst for water gas shift
 reaction and for dry CO₂ reforming of methane)
 IT 329722-20-5, Molybdenum carbide
 (Mo₂C_{0.95-1.05})
 (carbiding of; high-surface-area molybdenum

- carbide** as catalyst for **water gas shift reaction** and for dry CO2 **reforming** of methane)
- IT 1313-27-5, Molybdenum oxide, processes 11098-84-3, Ammonium molybdate 11098-99-0, Molybdenum oxide 12027-67-7, Ammonium molybdate 13106-76-8, Ammonium molybdate (carbiding of; high-surface-area **molybdenum carbide** as catalyst for **water gas shift reaction** and for dry CO2 **reforming** of methane)
- IT 12069-89-5, Molybdenum carbide (Mo2C) (high-surface-area **molybdenum carbide** as catalyst for **water gas shift reaction** and for dry CO2 **reforming** of methane)
- IT 124-38-9, Carbon dioxide, processes (methane **reforming** with; high-surface-area **molybdenum carbide** as catalyst for **water gas shift reaction** and for dry CO2 **reforming** of methane)
- L27 ANSWER 6 OF 25 HCA COPYRIGHT 2004 ACS on STN
- 137:188010 A catalyst and method of **steam reforming**. Wang, Yong; Tonkovich, Anna Lee Y.; Vanderwiel, David P. (Battelle Memorial Institute, USA). PCT Int. Appl. WO 2002066371 A2 20020829, 32 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR. (English). CODEN: PIXXD2. APPLICATION: WO 2002-US4479 20020215. PRIORITY: US 2001-788293 20010216; US 2002-76881 20020213.
- AB The present invention provides a method of **steam reforming** a hydrocarbon over a catalyst at short residence times or short contact times. The present invention also provides spinel-contg. catalysts. Surprisingly superior results and properties obtained in methods and catalysts of the present invention are also described.
- IC ICM C01B003-40
ICS B01J027-22; B01J023-00; B01J023-40; B01J023-46; B01J035-10; B01J035-04; B01J037-02
- CC 51-4 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 67
- ST **steam reforming** catalyst synthetic crude

- IT Diesel fuel
Fischer-Tropsch reaction
Jet aircraft fuel
 Steam reforming
 (a catalyst and method of **steam reforming**
 esp. Fischer-Tropsch synthetic fuels)
- IT Group IVB element carbides
Spinel-group minerals
 (a catalyst and method of **steam reforming**
 esp. Fischer-Tropsch synthetic fuels)
- IT Gasoline
Petroleum, processes
 (a catalyst and method of **steam reforming**
 esp. Fischer-Tropsch synthetic fuels)
- IT Petroleum **reforming** catalysts
 (**steam reforming**; a catalyst and method of
 steam reforming esp. Fischer-Tropsch synthetic
 fuels)
- IT Fuels
 (synthetic; a catalyst and method of **steam**
 reforming esp. Fischer-Tropsch synthetic fuels)
- IT 1314-23-4, Zirconia, uses 7439-88-5, Iridium, uses 7440-02-0,
Nickel, uses 7440-05-3, Palladium, uses 7440-06-4, Platinum,
uses 7440-16-6, Rhodium, uses 7440-18-8, Ruthenium, uses
12068-51-8, Aluminum magnesium oxide (Al₂MgO₄) 12070-12-1,
Tungsten carbide 12627-57-5, **Molybdenum carbide**
12680-36-3, Rhodium oxide
 (a catalyst and method of **steam reforming**
 esp. Fischer-Tropsch synthetic fuels)
- IT 74-82-8, Methane, processes 106-97-8, Butane, processes
540-84-1, Isooctane
 (a catalyst and method of **steam reforming**
 esp. Fischer-Tropsch synthetic fuels)
- IT 10139-58-9, Rhodium nitrate 10377-60-3, Magnesium nitrate
 (a catalyst and method of **steam reforming**
 esp. Fischer-Tropsch synthetic fuels)
- IT 12606-73-4
 (catalyst support; a catalyst and method of **steam**
 reforming esp. Fischer-Tropsch synthetic fuels)
- IT 1309-48-4, Magnesium oxide (MgO), uses
 (passivation layer; a catalyst and method of **steam**
 reforming esp. Fischer-Tropsch synthetic fuels)
- IT 1344-28-1, γ -Alumina, uses
 (γ ; a catalyst and method of **steam**
 reforming esp. Fischer-Tropsch synthetic fuels)

Wang, Young; Tonkovich, Anna Lee Y.; Vanderwiel, David P. (USA).
U.S. Pat. Appl. Publ. US 20010032965 A1 20011025, 13 pp.,
Cont.-in-part of U.S. Ser. No. 375,615. (English). CODEN: USXXCO.
APPLICATION: US 2001-788293 20010216. PRIORITY: US 1999-375615
19990817; US 1999-375614 19990817; US 2000-640903 20000816.

- AB The invention provides a method of **steam reforming**
a hydrocarbon over a spinel-contg. catalyst at short residence times
or short contact times. The invention also provides spinel-contg.
catalysts. Superior results and properties obtained in methods and
catalysts of the invention are also described.
- IC ICM C01B003-26
ICS C01B003-32; C01B003-40; B01J023-24
- NCL 252373000
- CC 49-1 (Industrial Inorganic Chemicals)
- ST **steam reforming** hydrocarbon; catalyst
steam reforming hydrocarbon
- IT Hydrocarbons, processes
(catalyst and method for **steam reforming** of)
- IT **Steam reforming** catalysts
(for hydrocarbons)
- IT **Steam reforming**
(of hydrocarbons)
- IT Diesel fuel
Jet aircraft fuel
(**steam reforming** of)
- IT Gasoline
(**steam reforming** of)
- IT Petroleum **reforming**
(**steam reforming** of synthetic crude)
- IT 1302-67-6, Spinel 1309-48-4, Magnesia, uses 1344-28-1, Alumina,
uses 7439-88-5, Iridium, uses 7440-02-0, Nickel, uses
7440-05-3, Palladium, uses 7440-06-4, Platinum, uses 7440-16-6,
Rhodium, uses 7440-18-8, Ruthenium, uses 12070-12-1, Tungsten
carbide 12627-57-5, **Molybdenum carbide**
(in **steam reforming** catalyst)
- IT 74-82-8, Methane, processes 106-97-8, Butane, processes
26635-64-3, Isooctane
(**steam reforming** of)

L27 ANSWER 8 OF 25 HCA COPYRIGHT 2004 ACS on STN

135:291413 Transition metal carbides, nitrides and borides and their
oxygen containing analogs useful as **water gas**
shift catalysts. Thompson, Levi T.; Patt, Jeremy; Moon, Dong Ju;
Phillips, Cory (University of Michigan, USA). PCT Int. Appl. WO
2001074484 A2 20011011, 28 pp. DESIGNATED STATES: W: AE, AG, AL,
AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ,
DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN,
IS, JP, KE, KG, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK,

MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, AZ, BY; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR. (English). CODEN: PIXXD2. APPLICATION: WO 2001-US10261 20010330. PRIORITY: US 2000-PV193553 20000331.

AB Mono- and bimetallic transition metal carbides, nitrides and borides, and their oxygen contg. analogs (e.g. oxycarbides) for use as **water gas** shift catalysts are described. In a preferred embodiment, the catalysts have the general formula of M_1AM_2BZCOD , wherein M1 is selected from the group consisting of Mo, W, and combinations thereof; M2 is selected from the group consisting of Fe, Ni, Cu, Co, and combinations thereof; Z is selected from the group consisting of carbon, nitrogen, boron, and combinations thereof; A is an integer; B is 0 or an integer greater than 0; C is an integer; O is oxygen; and D is 0 or an integer greater than 0. The catalysts exhibit good reactivity, stability, and sulfur tolerance, as compared to conventional **water** shift **gas** catalysts. These catalysts hold promise for use in conjunction with proton exchange membrane fuel cell powered systems.

IT 12069-89-5, molybdenum carbide
mo2c

(transition metal carbides, nitrides and borides and their oxygen contg. analogs useful as **water gas** shift catalysts)

RN 12069-89-5 HCA

CN Molybdenum carbide (Mo2C) (8CI, 9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IC B01J027-00

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 49, 67

ST fuel cell **water gas** shift catalyst

IT Carbides

Oxides (inorganic), uses

(oxycarbides; transition metal carbides, nitrides and borides and their oxygen contg. analogs useful as **water gas** shift catalysts)

IT Fuel cells

Reduction catalysts

Water gas shift reaction
catalysts

(transition metal carbides, nitrides and borides and their oxygen contg. analogs useful as **water gas** shift catalysts)

IT Transition metal borides

Transition metal carbides

Transition metal nitrides

(transition metal carbides, nitrides and borides and their oxygen contg. analogs useful as **water gas** shift catalysts)

IT 12069-89-5, **molybdenum carbide**

mo2c 365217-85-2, Iron **molybdenum**

carbide (Fe₄Mo₇C) 365217-87-4, Iron **molybdenum**

carbide (Fe₇Mo₄C) 365217-88-5, Molybdenum nickel carbide

(Mo₁₁Ni₆C) 365217-89-6, Molybdenum nickel carbide (Mo₁₄Ni₂₃C)

365217-90-9, Copper **molybdenum carbide** (CuMo₂C)

365217-91-0, Copper **molybdenum carbide** (Cu₃Mo₂C)

(transition metal carbides, nitrides and borides and their oxygen contg. analogs useful as **water gas** shift catalysts)

IT 630-08-0, Carbon monoxide, processes

(transition metal carbides, nitrides and borides and their oxygen contg. analogs useful as **water gas** shift catalysts)

L27 ANSWER 9 OF 25 HCA COPYRIGHT 2004 ACS on STN

134:199557 Assessment of TRAC-BF1 for waterhammer calculations with entrapped air. Brinckman, Kevin W.; Chaiko, Mark A. (PPL Corporation, Allentown, PA, 18101, USA). Nuclear Technology, 133(1), 133-139 (English) 2001. CODEN: NUTYBB. ISSN: 0029-5450. Publisher: American Nuclear Society.

AB The TRAC-BF1 computer code is used to analyze the fluid pressure response for a waterhammer event in a H₂O-filled pipe with entrapped air. TRAC's capabilities are assessed by comparison against a method-of-characteristics (**MOC**) soln. of pressure-wave propagation in a gas/liq. interface system. A vertically oriented pipe with air initially occupying up to 10% of the pipe vol. is considered. A step increase in pressure is imposed at the inlet, and the fluid pressure response in the pipe is calcd. TRAC correctly predicts that the peak pressure with entrapped air is substantially higher than it would be in a purely liq. system. For an initial air vol. equal to 10% of the pipe vol., the peak pressure calcd. by TRAC compares within 1% of the **MOC** result. For smaller initial air vols., TRAC underpredicts the peak pressure disturbance by up to 14% compared to the **MOC**. The TRAC soln. exhibits a degree of long-term artificial damping, but in all cases it captures the basic features of the pressure response for a waterhammer event in a system with entrapped air.

CC 71-4 (Nuclear Technology)

IT Surface

(**gas**-liq., air **water**; assessment of TRAC-BF1 for waterhammer calcns. with entrapped air on)

L27 ANSWER 10 OF 25 HCA COPYRIGHT 2004 ACS on STN

134:180675 A method and catalyst structure for **steam**

reforming of a hydrocarbon. Wang, Yong; Vanderwiel, David P.; Tonkovich, Anna Lee Y. (Battelle Memorial Institute, USA). PCT Int. Appl. WO 2001012540 A1 20010222, 10 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG. (English). CODEN: PIXXD2. APPLICATION: WO 2000-US22421 20000815. PRIORITY: US 1999-375615 19990817.

- AB A method of **steam reforming** of a hydrocarbon having the steps of flowing a mixt. of **steam** and the hydrocarbon past a supported catalyst having a support and a catalyst metal thereon, and reacting the mixt. at 600-1000° forming at least one product wherein the improvement comprises: the support is a spinel support and the flowing is at a rate providing a residence time .ltorsim.0.1 s and forming the same or greater compared to the forming of a longer residence time. Another improvement of the present invention is operation at a **steam** to carbon ratio that is substantially stoichiometric and maintaining activity of the supported catalyst. The present invention also includes a catalyst structure for **steam reforming** of a hydrocarbon.
- IC ICM C01B003-38
- CC 49-10 (Industrial Inorganic Chemicals)
Section cross-reference(s): 51, 67
- ST catalyst structure **steam reforming** hydrocarbon
- IT **Steam reforming**
 Steam reforming catalysts
 (method and catalyst structure for **steam reforming** of hydrocarbon)
- IT Group IVB element carbides
 (method and catalyst structure for **steam reforming** of hydrocarbon)
- IT Hydrocarbons, reactions
 (method and catalyst structure for **steam reforming** of hydrocarbon)
- IT Synthesis gas manufacturing
 (**steam reforming** synthesis gas manufg.;
 method and catalyst structure for **steam reforming** of hydrocarbon)
- IT 7439-88-5, Iridium, uses 7440-02-0, Nickel, uses 7440-05-3, Palladium, uses 7440-06-4, Platinum, uses 7440-16-6, Rhodium, uses 11130-73-7, Tungsten carbide 12036-35-0, Rhodium oxide rh2o3 12627-57-5, **Molybdenum carbide**
 (method and catalyst structure for **steam**

- reforming** of hydrocarbon)
IT 1309-48-4, Magnesia, uses 1344-28-1, Alumina, uses
(method and catalyst structure for **steam**
reforming of hydrocarbon)
- L27 ANSWER 11 OF 25 HCA COPYRIGHT 2004 ACS on STN
134:149240 **Carbon monoxide** hydrogenation over
molybdenum carbide catalysts. Kim, Hyun-Gyu; Lee,
Kyung Hee; Lee, Jae Sung (Department of Chemical Engineering and
School of Environmental Engineering, Pohang University of Science
and Technology, Pohang, 790-784, S. Korea). Research on Chemical
Intermediates, 26(5), 427-443 (English) 2000. CODEN: RCINEE. ISSN:
0922-6168. Publisher: VSP BV.
- AB Supported and unsupported molybdenum and **molybdenum**
carbides have been studied as catalysts of CO-H₂
reactions at 570 K and atm. pressure. The initial turnover rates of
these catalysts were comparable to those of the more active group
VIII elements. However, all molybdenum-based catalysts showed a
hydrocarbon product distribution different from those for typical
group VIII metals. Furthermore, prodn. of a large amt. of CO₂
(instead of water) and a high paraffin/olefin ratio reflected high
activities of these catalysts for the **water-gas**
shift reaction and hydrogenation, resp. The high
water-gas shift reaction
activity allowed a CO-rich synthesis **gas** to be
used efficiently over Mo-based catalysts. The CO-H₂
reactions appear to be structure insensitive on **molybdenum**
carbide catalysts, since the rates were independent of
particle size and crystal structure of unsupported catalysts and of
metal loading of supported catalysts.
- IT 12069-89-5, DiMolybdenum carbide
(**carbon monoxide** hydrogenation over
molybdenum and **molybdenum carbide** catalysts)
- RN 12069-89-5 HCA
CN Molybdenum carbide (Mo₂C) (8CI, 9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
- IT 630-08-0, **Carbon monoxide**, reactions
(**carbon monoxide** hydrogenation over
molybdenum and **molybdenum carbide** catalysts)
- RN 630-08-0 HCA
CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)
- C≡O⁺
- CC 45-4 (Industrial Organic Chemicals, Leather, Fats, and Waxes)
ST **carbon monoxide** hydrogenation **molybdenum**
carbide catalyst

- IT Fischer-Tropsch catalysts
(**carbon monoxide** hydrogenation over
molybdenum and **molybdenum carbide** catalysts)
- IT Alkanes, preparation
Alkenes, preparation
(product; **carbon monoxide** hydrogenation over
molybdenum and **molybdenum carbide** catalysts)
- IT 7439-98-7, Molybdenum, uses 12069-89-5,
DiMolybdenum carbide 12627-57-5,
Molybdenum carbide
(**carbon monoxide** hydrogenation over
molybdenum and **molybdenum carbide** catalysts)
- IT 630-08-0, **Carbon monoxide**, reactions
(**carbon monoxide** hydrogenation over
molybdenum and **molybdenum carbide** catalysts)
- IT 1344-28-1, Alumina, uses
(catalyst support; **carbon monoxide**
hydrogenation over molybdenum and **molybdenum**
carbide catalysts)
- IT 74-82-8P, Methane, preparation 74-84-0P, Ethane, preparation
74-85-1P, Ethylene, preparation 74-98-6P, Propane, preparation
115-07-1P, Propylene, preparation
(product; **carbon monoxide** hydrogenation over
molybdenum and **molybdenum carbide** catalysts)
- L27 ANSWER 12 OF 25 HCA COPYRIGHT 2004 ACS on STN
133:337411 **Molybdenum carbide** catalysts for
water gas shift. Patt, Jeremy; Phillips, Cory;
Thompson, Levi (Department of Chemical Engineering, University of
Michigan, Ann Arbor, MI, 48109-2136, USA). Proceedings of the Power
Sources Conference, 39th, 224-227 (English) 2000. CODEN: PPOCFD.
Publisher: National Technical Information Service.
- AB Two carbides, **Mo2C** and **NiMoCx**, were demonstrated to be
highly active for the **water gas** shift of a
synthetic **steam reformer** exhaust stream. The
high surface area **Mo2C** catalyst (61 m²/g) had a higher
gravimetric activity than a com. Cu-Zn-Al shift catalyst (60 m²/g)
under the reaction conditions employed (220-295°C, 1 atm).
There was no apparent deactivation or modification of the structure
during 48 h onstream. The **NiMoCx** catalyst (14 m²/g) was as active
as the Cu-Zn-Al catalyst on a gravimetric basis, but when rates were
normalized by surface area, **NiMoCx** was more active than the
Mo2C and Cu-Zn-Al catalysts. None of these materials
catalyzed the methanation reaction. The results suggest that mono-
and bimetallic carbides are promising candidates for development as
com. **water gas** shift catalysts.
- IT 12069-89-5, **Molybdenum carbide**
mo2c

(molybdenum carbide catalysts for
water gas shift)

RN 12069-89-5 HCA

CN Molybdenum carbide (Mo₂C) (8CI, 9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 49, 52, 67

ST molybdenum carbide catalyst water
gas shift

IT Water gas shift reaction
catalysts
(molybdenum carbide catalysts for
water gas shift)

IT 12069-89-5, Molybdenum carbide
mo₂c 252953-91-6, Molybdenum nickel carbide
(molybdenum carbide catalysts for
water gas shift)

IT 1333-74-0P, Hydrogen, preparation
(molybdenum carbide catalysts for
water gas shift)

L27 ANSWER 13 OF 25 HCA COPYRIGHT 2004 ACS on STN

133:225297 Methane dry **reforming**: effects of pressure and
promoters on carbon formation. Shamsi, Abolghasem (National Energy
Technology Laboratory, U.S. Department of Energy, Morgantown, WV,
26505-0880, USA). Preprints of Symposia - American Chemical
Society, Division of Fuel Chemistry, 45(4), 690-693 (English) 2000.
CODEN: PSADFZ. ISSN: 1521-4648. Publisher: American Chemical
Society, Division of Fuel Chemistry.

AB We report the prepn. and testing of catalysts for dry
reforming of methane to syngas at atm. and at high pressures
with and without promoters. Ni-based and carbide catalysts were
very active and selective for producing syngas. However, a
significant amt. of C formed on the com. Ni-based catalysts,
plugging the reactor after 5 h on stream. The amt. of C deposition
was reduced significantly due to addn. of alkali and alk. earth
metals. Methane conversion decreased as the pressure increased, due
to water formation via the reverse **water gas**
shift reaction. **Mo carbide**
catalyst is stable for 10 h.

CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 49, 67

ST catalyst methane dry **reforming**

IT Alkali metals, uses
Alkaline earth metals
(catalyst promoter; effects of pressure and promoters on carbon
formation in methane dry **reforming** with carbon dioxide)

IT **Reforming**

Reforming catalysts

(effects of pressure and promoters on carbon formation in methane dry **reforming** with carbon dioxide)

IT Synthesis gas manufacturing

(**reforming** synthesis gas manufg.; effects of pressure and promoters on carbon formation in methane dry **reforming** with carbon dioxide)

IT 7440-02-0, Nickel, uses 11130-73-7, Tungsten carbide 12627-57-5, **Molybdenum carbide** 13463-67-7, Titania, uses

(effects of pressure and promoters on carbon formation in methane dry **reforming** with carbon dioxide)

IT 7440-44-0, Carbon, formation (nonpreparative)

(effects of pressure and promoters on carbon formation in methane dry **reforming** with carbon dioxide)

IT 74-82-8, Methane, reactions 124-38-9, Carbon dioxide, reactions

(effects of pressure and promoters on carbon formation in methane dry **reforming** with carbon dioxide)

L27 ANSWER 14 OF 25 HCA COPYRIGHT 2004 ACS on STN

132:299448 **Molybdenum carbide** catalysts for

water-gas shift. Patt, Jeremy; Moon, Dong Ju; Phillips, Cory; Thompson, Levi (Department of Chemical Engineering, University of Michigan, Ann Arbor, MI, 48109-2136, USA). Catalysis Letters, 65(4), 193-195 (English) 2000. CODEN: CALEER. ISSN: 1011-372X. Publisher: Baltzer Science Publishers.

AB **Molybdenum carbide** (Mo2C) was

demonstrated to be highly active for the **water-gas** shift of a synthetic **steam reformer** exhaust stream. This catalyst was more active than a com. Cu-Zn-Al shift catalyst under the conditions employed (220-295°C and atm. pressure). In addn., Mo2C did not catalyze the methanation reaction. There was no apparent deactivation or modification of the structure during 48 h onstream. The results suggest that high surface area carbides are promising candidates for development as com. **water-gas** shift catalysts.

IT 12069-89-5, **Molybdenum carbide**(
Mo2C)

(**molybdenum carbide** catalysts for
water-gas shift)

RN 12069-89-5 HCA

CN **Molybdenum carbide** (Mo2C) (8CI, 9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CC 67-1 (Catalysis, Reaction Kinetics, and Inorganic Reaction Mechanisms)

ST **molybdenum carbide** catalyst **water**
gas shift reaction

IT **Water gas** shift reaction
catalysts

(molybdenum carbide catalysts for
water-gas shift)

IT 12069-89-5, Molybdenum carbide(
Mo2C)
(molybdenum carbide catalysts for
water-gas shift)

L27 ANSWER 15 OF 25 HCA COPYRIGHT 2004 ACS on STN
128:142879 Synthesis of early transition metal carbides and their
application for the **reforming** of methane to synthesis gas.
York, A. P. E.; Claridge, J. B.; Marquez-Alvarez, C.; Brungs, A. J.;
Tsang, S. C.; Green, M. L. H. (The Catalysis Centre, Inorganic
Chemistry Laboratory, University of Oxford, Oxford, OX1 3QR, UK).
Studies in Surface Science and Catalysis, 110(3rd World Congress on
Oxidation Catalysis, 1997), 711-720 (English) 1997. CODEN: SSCTDM.
ISSN: 0167-2991. Publisher: Elsevier Science B.V..

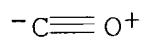
AB Binary and ternary group V and VI transition metal oxides were
converted to their carbides using temp. programmed redn. (TPR).
When ethane was substituted for methane in the TPR, transmission
electron microscopy indicated that the oxide-carbide transformation
proceeded topotactically. The carbides synthesized were tested as
catalysts for methane **reforming** with carbon dioxide (dry
reforming), giving **carbon monoxide** and
hydrogen (synthesis **gas**) as the main products; of
the binary carbides, only molybdenum and tungsten were active and
stable, displaying activities comparable to supported noble metal
catalysts. No carbon deposition was obsd. on post-catalytic carbide
samples. Molybdenum and tungsten carbides were also active for
methane **reforming** with air (partial oxidn.) and water (
steam reforming). No synergistic effects were
evident in the ternary carbides, and only those with a high ratio of
Mo/W to group V metal exhibited significant catalytic activity and
stability.

IT 12069-89-5, Molybdenum carbide (
Mo2C)
(synthesis of early transition metal carbides and their
application for the **reforming** of methane to synthesis
gas)

RN 12069-89-5 HCA
CN Molybdenum carbide (Mo2C) (8CI, 9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
CC 51-5 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 67
ST methane **reforming** catalyst transition metal carbide
IT **Reforming** catalysts
(synthesis of early transition metal carbides and their
application for the **reforming** of methane to synthesis
gas)

- IT Transition metal carbides
(synthesis of early transition metal carbides and their application for the **reforming** of methane to synthesis gas)
- IT 12069-89-5, Molybdenum carbide (Mo₂C) 12069-94-2, Niobium carbide 12070-12-1, Tungsten carbide 51680-51-4, Tantalum carbide
(synthesis of early transition metal carbides and their application for the **reforming** of methane to synthesis gas)
- IT 74-82-8, Methane, processes
(synthesis of early transition metal carbides and their application for the **reforming** of methane to synthesis gas)
- L27 ANSWER 16 OF 25 HCA COPYRIGHT 2004 ACS on STN
126:188211 Molybdenum and tungsten carbides as catalysts for the conversion of methane to synthesis gas using stoichiometric feedstocks. York, Andrew P. E.; Claridge, John B.; Brungs, Attila J.; Tsang, Shik Chi; Green, Malcolm L. H. (Catalysis Centre, Inorganic Chem. Lab., Univ. Oxford, Oxford, OX1 3QR, UK). Chemical Communications (Cambridge) (1), 39-40 (English) 1997. CODEN: CHCOFS. ISSN: 1359-7345. Publisher: Royal Society of Chemistry.
- AB Molybdenum and tungsten carbides (β - Mo₂C, Mo₂C/Al₂O₃, and WC) are extremely active and stable catalysts for the dry **reforming**, partial oxidn. and **steam reforming** of methane to synthesis gas using stoichiometric feedstocks. The carbides were prepd. by temp.-controlled redn. of the bulk oxides or supported oxides with CH₄ or CH₄-H₂ mixts. No bulk carbon deposition was obsd.
- IT 12069-89-5, Molybdenum carbide (Mo₂C)
(molybdenum and tungsten carbide catalysts for methane conversion to synthesis gas by partial oxidn. and **steam reforming**)
- RN 12069-89-5 HCA
CN Molybdenum carbide (Mo₂C) (8CI, 9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
ST **molybdenum carbide** methane synthesis gas;
tungsten carbide methane synthesis gas; methane synthesis gas
molybdenum tungsten carbide; partial oxidn methane synthesis gas
carbide; **steam reforming** methane synthesis gas
carbide
- IT Synthesis gas manufacturing
(partial oxidn.; molybdenum and tungsten carbide catalysts for methane conversion to synthesis gas by partial oxidn. and **steam reforming**)

- IT Synthesis gas manufacturing
Synthesis gas manufacturing
(**steam reforming** synthesis gas manufg.;
molybdenum and tungsten carbide catalysts for methane conversion
to synthesis gas by partial oxidn. and **steam
reforming**)
- IT 7440-44-0, Carbon, formation (nonpreparative)
(catalyst deposits; on molybdenum and tungsten carbide catalysts
for methane conversion to synthesis gas by partial oxidn. and
steam reforming)
- IT 12069-89-5, Molybdenum carbide (
Mo2C) 12070-12-1, Tungsten carbide (WC)
(molybdenum and tungsten carbide catalysts for methane conversion
to synthesis gas by partial oxidn. and **steam
reforming**)
- IT 74-82-8, Methane, reactions
(molybdenum and tungsten carbide catalysts for methane conversion
to synthesis gas by partial oxidn. and **steam
reforming**)
- L27 ANSWER 17 OF 25 HCA COPYRIGHT 2004 ACS on STN
124:150312 New Methane Chemistry Synthesis of Materials for Reversible
Uptake and Useful Functionalization of Methane. Final Report,
September 1987-December-1994. Green, M. L. H. (Inorg. Chem. Lab.,
Oxford Univ., UK). Report, GRI-95/0129; Order No. PB-115027GAR, 28
pp. Avail. NTIS From: Gov. Rep. Announce. Index (U. S.) 1996,
96(2), Abstr. No. 02-00,989 (English) 1995.
- AB It has been shown that the direct reaction between methane and
oxygen may be catalyzed so that at 1100 K **carbon
monoxide** and hydrogen are formed with very high yields
(90-96%). This partial oxidn. reaction has been studied in detail,
and the evidence suggests it may provide an alternative and improved
route to the industrial prodn. of synthesis gas. A new class of
catalyst for partial oxidn. and **steam reforming**
of methane to synthesis gas has been discovered. The catalyst is
based on **molybdenum carbide** and may have
economic advantages over conventional catalysts based on precious
metals.
- IT 630-08-0P, Carbon monoxide, preparation
1333-74-0P, Hydrogen, preparation
(partial oxidn. and **steam reforming** of
methane to synthesis gas)
- RN 630-08-0 HCA
CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)



RN 1333-74-0 HCA
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 67

ST oxidn partial methane synthesis gas; **steam**
reforming methane **molybdenum carbide**
catalyst

IT Fuel gas manufacturing
(**steam reforming, molybdenum**
carbide catalyst for **steam reforming**
of methane to synthesis gas)

IT **630-08-0P, Carbon monoxide**, preparation
1333-74-0P, Hydrogen, preparation
(partial oxidn. and **steam reforming** of
methane to synthesis gas)

IT 74-82-8, Methane, processes
(partial oxidn. and **steam reforming** of
methane to synthesis gas)

L27 ANSWER 18 OF 25 HCA COPYRIGHT 2004 ACS on STN

120:36360 Carbonization of substrates, manufacture of composite ceramic
substrates, and disposal of carbon-containing substances. Shoji,
Masashi; Hirose, Yoichi (Hoshin Kagaku Sangyosho KK, Japan; SMC
Corp.). Jpn. Kokai Tokkyo Koho JP 05246785 A2 19930924 Heisei, 10
pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1992-47214
19920304.

AB The carbonization process comprises (1) placing substrates in molten
carbonate salts (M) or M-contg. molten salts, (2) placing substrates
in M, M-contg. molten salts, or M-free molten salts in a container
and feeding a C-contg. gas to the container, or (3) placing
substrates in liq. consisting of C-contg. liq. and M, M-contg.
molten salts, or M-free molten salts. The composite ceramic
substrates are manufd. by forming carbide layers on substrates by
the above carbonization process. In the disposal by using the
carbonization process, C-contg. substances are adsorbed by
substrates, and the substrates are carbonized. Metals and nonmetals
are directly carbonized from their surface to give carbide products
easily at low cost, and the disposal process is suitable for CO₂ and
CO as waste gases and C-contg. wastewater.

IT **12011-97-1P, Molybdenum carbide** (
MoC) **12069-89-5P, Molybdenum**
carbide (Mo₂C)
(formation of, on substrates, in molten salts, for ceramic
composite manuf. or waste **gas** or **water**)

treatment)

RN 12011-97-1 HCA

CN Molybdenum carbide (MoC) (6CI, 8CI, 9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

RN 12069-89-5 HCA

CN Molybdenum carbide (Mo₂C) (8CI, 9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IC ICM C04B041-87

ICS C23C018-12

CC 56-6 (Nonferrous Metals and Alloys)

Section cross-reference(s): 57, 59, 60

IT Carbides

(formation of, on substrates, in molten salts, for ceramic composite manuf. or waste **gas** or **water** treatment)

IT 74-82-8, Methane, uses 74-86-2, Acetylene, uses 74-98-6, Propane, uses 124-38-9, Carbon dioxide, uses 630-08-0, Carbon monoxide, uses

(carbide formation with, on substrates, in molten salts, for ceramic composite manuf. or waste **gas** or **water** treatment)

IT 12011-97-1P, Molybdenum carbide (MoC) 12069-89-5P, Molybdenum carbide (Mo₂C) 12070-12-1P, Tungsten carbide

(formation of, on substrates, in molten salts, for ceramic composite manuf. or waste **gas** or **water** treatment)

IT 497-19-8, Sodium carbonate, uses 554-13-2, Lithium carbonate 584-08-7, Potassium carbonate

(molten, carbide formation on substrates in, for ceramic composite manuf. or waste **gas** or **water** treatment)

L27 ANSWER 19 OF 25 HCA COPYRIGHT 2004 ACS on STN

108:24267 Catalytic **steam** gasification of carbon: final report, 3/1/84-2/28/87. Boudart, M. (Dep. Chem. Eng., Stanford Univ., Stanford, CA, USA). Report, DOE/ER/10502-T1; Order No. DE87010658, 8 pp. Avail. NTIS From: Energy Res. Abstr. 1987, 12(17), Abstr. No. 35311 (English) 1987.

AB The formation of coke on the Pt surface of **reforming** catalysts was studied, and the prepn., surface reactivity, and catalytic activity of high-specific-surface-area Mo and W carbides.

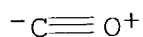
CC 51-6 (Fossil Fuels, Derivatives, and Related Products)

Section cross-reference(s): 67

ST **reforming** catalyst carbon deposit gasification; **molybdenum carbide reforming** catalyst gasification; tungsten carbide **reforming** catalyst

IT Petroleum refining catalysts

- (**reforming**, carbon deposition on, **steam** gasification in relation to)
- IT 7440-06-4, Platinum, uses and miscellaneous (catalysts, for petroleum **reforming**, carbon deposition on and **steam** gasification of)
- IT 11130-73-7, Tungsten carbide 12627-57-5, **Molybdenum carbide** (catalysts, for petroleum **reforming**, surface reactivity and activity of)
- IT 7440-44-0P, Carbon, preparation (formation of, on **reforming** catalysts, **steam** gasification in relation to)
- L27 ANSWER 20 OF 25 HCA COPYRIGHT 2004 ACS on STN
- 106:87174 Process for **reforming** alcohols. Fox, Joseph R.; Pesa, Frederick A.; Curatolo, Benedict S. (Standard Oil Co., USA). U.S. US 4632774 A 19861230, 4 pp. (English). CODEN: USXXAM. APPLICATION: US 1983-531965 19830914.
- AB Alcs. are **reformed** to synthesis gas by contacting the alcs. in the absence of **steam** with a catalyst consisting of a carbide of, e.g., Fe, Co, and/or Mn, at 200-600, e.g. 300-500°. The alc. may be a satd., unsatd., mono- or polyhydric C1-6 alc., e.g., MeOH or EtOH. The catalyst may be Fe3C, Co3C, or Mn3C-Mn5C2. The process may be carried out at atm. pressure or at 1-300 atm. The alc. may be a byproduct of the synthesis-gas-upgrading reaction, and the synthesis gas from the **reforming** reaction may be combusted, e.g., in the absence of co-fed H and in the presence of co-fed O. The product synthesis gas from MeOH consists predominantly of CO and H. This process is highly selective for synthesis gas from alc., i.e., little CH4 is produced and the catalyst is not exptl. affected by C deposition. The alcs. may be used as alternatives to conventional fuels, e.g., gasoline. Thus, MeOH 0.1 mL/min was vaporized and passed upward through a reactor contg. a catalyst bed of Co3C 5 g. At a reaction temp. of 200-400° the C selectivity to CO, i.e. the no. of moles of CO formed multiplied by 100% and divided by the total no. of moles of C atoms in the product, was 98.6%, and the product were **H2** 64.5, CO 35.0, CO2 0.3, and CH4 0.2 mol%, whereas no CO was produced in a reactor without catalyst.
- IT **630-08-0P, Carbon monoxide**, preparation
1333-74-0P, Hydrogen, preparation
 (prepn. of, by **reforming** of alcs. over metal carbide catalysts)
- RN 630-08-0 HCA
- CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)



RN 1333-74-0 HCA
 CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT **12011-98-2, Molybdenum carbide** (Mo₃C)
 (reforming catalyst, for synthesis gas prodn. from
 alcs.)
 RN 12011-98-2 HCA
 CN Molybdenum carbide (Mo₃C) (6CI, 7CI, 8CI, 9CI) (CA INDEX NAME)

| Component | Ratio | Component Registry Number |
|-----------|-------|------------------------------|
| C | 1 | 7440-44-0 |
| Mo | 3 | 7439-98-7 |

IC ICM C01B003-22
 NCL 252373000
 CC 49-8 (Industrial Inorganic Chemicals)
 Section cross-reference(s): 51
 ST alc methanol **reforming** catalyst; iron carbide alc
reforming catalyst; cobalt carbide alc **reforming**
 catalyst; manganese carbide alc **reforming** catalyst;
 synthesis gas metal carbide catalyst
 IT Fuel gas manufacturing
 (from alcs., by catalytic **reforming**)
 IT **Reforming** catalysts
 (metal carbides, synthesis gas prodn. from alcs. over)
 IT 74-82-8P, Methane, preparation 74-84-0P, Ethane, preparation
 74-85-1P, Ethene, preparation 115-07-1P, Propene, preparation
 (formation of, in synthesis gas from **reforming** of alcs.
 over metal carbide catalysts)
 IT **630-08-0P, Carbon monoxide**, preparation
1333-74-0P, Hydrogen, preparation
 (prepn. of, by **reforming** of alcs. over metal carbide
 catalysts)
 IT 12011-59-5, Cobalt carbide (Co₃C) 12011-67-5, Iron carbide (Fe₃C)
12011-98-2, Molybdenum carbide (Mo₃C)
 12012-35-0, Chromium carbide (Cr₃C₂) 12070-12-1, Tungsten carbide
 (WC) 12071-17-9, Manganese carbide (Mn₅C₂) 12121-90-3, Manganese
 carbide (Mn₃C)
 (**reforming** catalyst, for synthesis gas prodn. from
 alcs.)
 IT 64-17-5, Ethanol, reactions 67-56-1, Methanol, reactions
 (**reforming** of, over metal carbide catalysts, for

synthesis gas prodn.)

L27 ANSWER 21 OF 25 HCA COPYRIGHT 2004 ACS on STN

98:60641 Catalyst or catalytic composition, paraffinic hydrocarbons and ammonia. McCandlish, Larry E.; Turaew, Larissa W.; Wright, Franklin J.; Kugler, Edwin L. (Exxon Research and Engineering Co. , USA). Braz. Pedido PI BR 8107618 A 19820817, 43 pp. (Portuguese). CODEN: BPXXDX. APPLICATION: BR 1981-7618 19811123. PRIORITY: US 1980-209998 19801124; US 1980-216139 19801215; US 1980-216542 19801215; US 1981-243824 19810316; US 1981-304139 19810923.

AB Catalysts or catalytic compns. of fcc. Mo oxycarbonitrides can be obtained by thermal decompn., at relatively low temps., of amine molybdates. They may be amorphous or of low crystallinity and have high sp. surface area (≥ 130 m²/g). The cryst. compns. have a general formula Mo_aO_bCbN_c, where a, b, and c >0, and a + b + c ≤ 1 , as shown by x-ray diffraction or chem. anal. The compns. can be used as catalysts in the prodn. of hydrocarbons from CO + H₂, or CO + H₂O(g), and of NH₃ from N₂ + H₂.

IC B01J023-28; C07C001-02; C01B002-087

CC 67-1 (Catalysis, Reaction Kinetics, and Inorganic Reaction Mechanisms)

Section cross-reference(s): 49, 51

ST catalyst molybdenum oxycarbonitride prepn; ammonia synthesis catalyst molybdenum oxycarbonitride; **water gas** shift catalyst; hydrogenation catalyst **carbon monoxide**; hydrocarbon synthesis catalyst molybdenum oxycarbonitride

IT Catalysts and Catalysis
Hydrogenation catalysts

Water gas shift reaction
catalysts

(**molybdenum carbide** nitride oxides, prepd. by thermal decompn. of amine molybdates)

L27 ANSWER 22 OF 25 HCA COPYRIGHT 2004 ACS on STN

97:181698 Carbon monoxide hydrogenation using steam and a molybdenum oxycarbonitride catalyst. McCandlish, Larry E.; Wright, Franklin J.; Kugler, Edwin L. (Exxon Research and Engineering Co. , USA). U.S. US 4345038 A 19820817, 3 pp. Cont.-in-part of U.S. Ser. No. 216,139, Abandoned (English). CODEN: USXXAM. APPLICATION: US 1981-304980 19810923. PRIORITY: US 1980-216139 19801215.

AB Paraffinic hydrocarbons including C1-10 linear and branched chains were prepd. by contacting a gaseous mixt. of CO/steam with a molybdenum oxycarbonitride catalyst at 100-600° and 0.1-100 MPa. Thus C1-6 linear alkanes were prepd. by treatment of CO/steam (3:1) with molybdenum oxycarbonitride at 300° and .apprx.0.8 MPa for 7 h.

IC C07C001-10

- NCL 518711000
CC 23-2 (Aliphatic Compounds)
ST **water gas shift reaction;**
molybdenum oxycarbonitride catalyst; alkane linear
IT **Water gas shift reaction**
catalysts
(molybdenum oxycarbonitride, linear alkanes from)
IT Alkanes, preparation
(**water gas shift reaction**
)
IT 1313-27-5D, solid solns. with **molybdenum carbide**
and molybdenum nitride 12627-57-5D, solid solns. with molybdenum
oxide and molybdenum nitride 37245-81-1D, solid solns. with
molybdenum oxide and **molybdenum carbide**
(catalysts, for **water gas shift**
reaction)
IT 74-82-8P, preparation 74-84-0P, preparation 74-98-6P,
preparation 106-97-8P, preparation 109-66-0P, preparation
110-54-3P, preparation
(prepn. of, from **water gas shift**
reaction)
- L27 ANSWER 23 OF 25 HCA COPYRIGHT 2004 ACS on STN
94:181369 The activity of several molybdenum compounds for the
methanation of carbon dioxide. Saito, Masahiro; Anderson, Robert B.
(Inst. Mater. Res., McMaster Univ., Hamilton, ON, Can.). Journal of
Catalysis, 67(2), 296-302 (English) 1981. CODEN: JCTLA5. ISSN:
0021-9517.
- AB Several Mo compds.-oxides, sulfide, metal, carbide, and nitride-were
prepd., and their catalytic properties in the hydrogenation of CO₂
at 350° were investigated and compared with those of Ni and
Fe. The initial specific activities, rates per unit surface area of
catalyst, decreased in the sequence Ni > **Mo**
carbide > Mo metal > Mo nitride > MoO₂ > MoS₂ > MoO₃. Fe
deactivated so rapidly that its initial activity could not be detd.
The Mo compds. produced very much smaller amts. of C₂ and C₃
hydrocarbons in the hydrogenation of CO₂ than in that of CO. Fe
produced the largest amt. of higher hydrocarbons from CO₂, and Ni
only CH₄. The Mo compds., except MoS₂ and MoO₃, had high activities
for **water-gas-shift reaction**
- CC 67-1 (Catalysis and Reaction Kinetics)
Section cross-reference(s): 51
- L27 ANSWER 24 OF 25 HCA COPYRIGHT 2004 ACS on STN
93:134682 The activity of several molybdenum compounds for the
methanation of carbon monoxide. Saito, M.; Anderson, R. B. (Inst.
Mater. Res., McMaster Univ., Hamilton, ON, Can.). Journal of

Catalysis, 63(2), 438-46 (English) 1980. CODEN: JCTLA5. ISSN: 0021-9517.

AB Several Mo catalysts (oxides, sulfide, metal, carbide, and nitride) were prep'd., and their catalytic properties in the methanation of CO at 350° C were investigated and compared with those of Ni and Fe. The initial sp. activities, i.e., rate per unit surface area of catalyst, decreased in the following sequence: Ni > **Mo carbide** > Mo > Mo nitride > MoO₂ > MoS₂ > MoO₃. The rate of aging, loss in activity for methanation, decreased in the following way: Fe > **Mo carbide** > Mo > Ni > MoS₂ > MoO₃. The rate of nitride > MoO₂. The 0-valent Mo compds. produced much larger amts. of C₂ and C₃ hydrocarbons than MoO₂ and MoS₂, and about the same amt. as Fe. Ni produced the smallest amt. of higher hydrocarbons. The Mo compds. except MoS₂ and MoO₃ had higher activities for the **water-gas-shift reaction** than Ni and Fe; Mo compds. were as active in 1H₂ + 1CO gas as in 3H₂ + 1CO feed; Ni and Fe were substantially less active in the CO-rich gas.

CC 51-4 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 67

L27 ANSWER 25 OF 25 HCA COPYRIGHT 2004 ACS on STN

53:110716 Original Reference No. 53:19765e-f Vapor-phase plating with molybdenum and tungsten. Schultze, H. W. (Am. Metal Climax, Inc., New York, NY). Metal Progress, 76(No. 3), 74-80 (Unavailable) 1959. CODEN: MEPOA7. ISSN: 0026-0665.

AB Deposits of W or Mo from the vapor phase have been produced successfully on a variety of metals, ceramics, glass, refractories, and graphite. The metallic vapor phase is produced by the thermal decompn. of the volatile carbonyl or by the H reduction of the volatile chloride (under reduced pressure for best results). With the carbonyl process, the C content of the deposit is controlled from 0 to 35 at. % by addns. of H and (or) **H₂O** to the **gas**. By addns. of hydrocarbons, H₂S, or B-contg. gases, deposits contg. metal carbide, sulfide, or boride are obtained.

CC 9 (Metallurgy)

IT 1317-33-5, Molybdenum sulfide 7439-98-7, Molybdenum 7440-33-7, Tungsten 12070-12-1, Tungsten carbide 12626-91-4, Molybdenum boride 12627-39-3, Tungsten boride 12627-57-5,
Molybdenum carbide

(coating with, by vapor deposition)

=> d 128 1-22 cbib abs hitstr hitind

L28 ANSWER 1 OF 22 HCA COPYRIGHT 2004 ACS on STN

139:71201 Use of transition metal nitrides and carbides as catalysts. Szymanska, Agnieszka; Lewandowski, Marek (Politech. Slaska, Gliwice,

- Pol.). Przemysl Chemiczny, 82(5), 335-341 (Polish) 2003. CODEN: PRCHAB. ISSN: 0033-2496. Publisher: Wydawnictwo SIGMA-NOT.
- AB A review with ref. covering prepn. (e.g., **Mo₂C**, Mo₂N, W₂C, W₂N), properties and applications of nitride and carbide interstitials in hydrotreatment of petroleum for fuels involving hydrodenitrogenation, hydrodesulfurization, hydrodeoxygenation and hydrodemetallization, prodn. of syngas, methanization of CO₂ and CO, **Fischer-Tropsch** synthesis, etc.
- IT **12069-89-5, Molybdenum carbide Mo₂C**
(transition metal nitrides and carbides as catalysts for petroleum hydrotreatment)
- RN 12069-89-5 HCA
- CN Molybdenum carbide (Mo₂C) (8CI, 9CI) (CA INDEX NAME)
- *** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
- CC 51-0 (Fossil Fuels, Derivatives, and Related Products)
- IT 12033-31-7, Molybdenum nitride Mo₂N 12033-72-6, Tungsten nitride W₂N **12069-89-5, Molybdenum carbide Mo₂C** 12070-13-2, Tungsten carbide W₂C
(transition metal nitrides and carbides as catalysts for petroleum hydrotreatment)
- L28 ANSWER 2 OF 22 HCA COPYRIGHT 2004 ACS on STN
- 138:356009 Attrition-resistant encapsulated templated silica-based catalysts for **Fischer-Tropsch** synthesis. Pham, Hien N.; Datye, Abhaya K. (University of New Mexico, USA). S. African ZA 2000002569 A 20001201, 48 pp. (English). CODEN: SFXAB. APPLICATION: ZA 2000-2569 20000524. PRIORITY: US 1999-PV136118 19990526.
- AB Attrition-resistant **Fischer-Tropsch** catalysts are prepd. by encapsulation of dispersed insol. inorg. compds. in a mesoporous structure, consisting of: (1) combining a water-sol. oxide support precursor, a solvent, and a surfactant, (2) dispersing an insol. compd. (e.g., a zeolite, a non-oxide active catalyst precursor, an active catalyst precursor, etc.) into the mixt., (3) spray drying the mixt. to produce dry powder, and (4) calcining the powder to yield a porous structure contg. the dispersed insol. compd. A pptn. control agent (e.g., HCl or HNO₃) is used to control the pptn. rate of the oxide support precursor (such as Si alkoxide, esp. tetra-Et orthosilicate, and alkoxides of Zr, Ti, and Al). The surfactant is typically a quaternary ammonium salt template, such as cetyltrimethylammonium bromide and chloride. Sonication is used as a preferred dispersing step.
- IC ICM B01J
- CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
- ST **Fischer Tropsch** attrition resistant catalyst; silica template encapsulation **Fischer Tropsch** catalyst; spray drying attrition resistant **Fischer**

- Tropsch catalyst**
- IT Zirconates
(alkoxides, catalyst support and precursor; attrition-resistant encapsulated templated silica-based catalysts for **Fischer-Tropsch** synthesis)
- IT Metal alkoxides
(aluminum, catalyst support and precursor; attrition-resistant encapsulated templated silica-based catalysts for **Fischer-Tropsch** synthesis)
- IT **Fischer-Tropsch catalysts**
(attrition-resistant encapsulated templated silica-based catalysts for **Fischer-Tropsch** synthesis)
- IT Nitrides
Zeolites (synthetic), uses
(attrition-resistant encapsulated templated silica-based catalysts for **Fischer-Tropsch** synthesis)
- IT Sound and Ultrasound
(dispersing method; attrition-resistant encapsulated templated silica-based catalysts for **Fischer-Tropsch** synthesis)
- IT Carbides
(metal; attrition-resistant encapsulated templated silica-based catalysts for **Fischer-Tropsch** synthesis)
- IT Polyphosphoric acids
(sodium salts; attrition-resistant encapsulated templated silica-based catalysts for **Fischer-Tropsch** synthesis)
- IT Drying
(spray; attrition-resistant encapsulated templated silica-based catalysts for **Fischer-Tropsch** synthesis)
- IT Metal alkoxides
(zirconium, catalyst support and precursor; attrition-resistant encapsulated templated silica-based catalysts for **Fischer-Tropsch** synthesis)
- IT 78-10-4D, Tetraethyl orthosilicate, titanium
(catalyst support and precursor; attrition-resistant encapsulated templated silica-based catalysts for **Fischer-Tropsch** synthesis)
- IT 78-10-4, Tetraethyl orthosilicate
(catalyst support; attrition-resistant encapsulated templated silica-based catalysts for **Fischer-Tropsch** synthesis)
- IT 7439-89-6, Iron, uses 7440-09-7, Potassium, uses 7440-50-8, Copper, uses
(catalysts; attrition-resistant encapsulated templated silica-based catalysts for **Fischer-Tropsch** synthesis)
- IT 1314-23-4, Zirconia, uses 1344-28-1, Alumina, uses 7631-86-9,

- Silica, uses 12627-57-5, **Molybdenum carbide**
12640-64-1, Iron carbide 13463-67-7, Titania, uses
(catalysts; attrition-resistant encapsulated templated
silica-based catalysts for **Fischer-Tropsch**
synthesis)
- IT 57-09-0, Cetyltrimethylammonium bromide 112-02-7,
Cetyltrimethylammonium chloride
(surfactant template; attrition-resistant encapsulated templated
silica-based catalysts for **Fischer-Tropsch**
synthesis)
- L28 ANSWER 3 OF 22 HCA COPYRIGHT 2004 ACS on STN
133:105473 Process and **molybdenum carbide** catalyst
for the selective manufacture of lower alkenes from carbon monoxide
and hydrogen. Lee, Jae-song; Kim, Jae-chang; So, Won-kyu (Pohang
Iron & Steel Co., Ltd., S. Korea; Korea Industrial Technology
Institute). Repub. Korea KR 9505371 B1 19950523, No pp. given
(Korean). CODEN: KRXXFC. APPLICATION: KR 1991-22221 19911205.
- AB **Molybdenum carbide** catalysts for lower olefin
prodn. are prep'd. by: (1) mixing either $\leq 30\%$ sodium,
potassium, or calcium hydroxides with molybdate; or (2) soaking
molybdate in a 30% alkali soln. These catalysts efficiently produce
ethylene or propylene from carbon monoxide and hydrogen.
- IC ICM C07C011-02
ICS C07C011-06; C07C011-00
- CC 35-2 (Chemistry of Synthetic High Polymers)
Section cross-reference(s): 23, 48, 67
- ST **molybdenum carbide** catalyst manuf ethylene
propylene; ethene propene manuf synthesis gas conversion catalyst;
Fischer Tropsch catalyst manuf lower alkene
- IT Alkenes, preparation
(lower; process and **molybdenum carbide**
catalyst for the selective manuf. of lower alkenes from carbon
monoxide and hydrogen)
- IT **Fischer-Tropsch** catalysts
(**molybdenum carbide** catalyst for the
selective manuf. of lower alkenes from carbon monoxide and
hydrogen)
- IT Alkali metal hydroxides
(prepn. of **Fischer-Tropsch** catalysts by the
reaction of molybdate with solns. of)
- IT Synthesis gas
(process and **molybdenum carbide** catalyst for
the selective manuf. of lower alkenes from)
- IT **Fischer-Tropsch** reaction
(selective manuf. of lower alkenes from carbon monoxide and
hydrogen)
- IT 12627-57-5P, **Molybdenum carbide**

- (process and **molybdenum carbide** catalyst for the selective manuf. of lower alkenes from carbon monoxide and hydrogen)
- IT 74-85-1P, Ethylene, preparation 115-07-1P, Propene, preparation (process and **molybdenum carbide** catalyst for the selective manuf. of lower alkenes from carbon monoxide and hydrogen)
- IT 630-08-0, Carbon monoxide, reactions 1305-62-0, Calcium hydroxide, reactions 1310-58-3, Potassium hydroxide, reactions 1310-73-2, Sodium hydroxide, reactions 1333-74-0, Hydrogen, reactions 11116-47-5, Molybdate (process and **molybdenum carbide** catalyst for the selective manuf. of lower alkenes from carbon monoxide and hydrogen)
- L28 ANSWER 4 OF 22 HCA COPYRIGHT 2004 ACS on STN
- 127:283838 XPS study of **Mo2C** catalysts. Ding, Zhengxin; Sheng, Shishan; Zhu, Junfa; Zhu, Xiaolei; Xiong, Guoxing; Zhuang, Shuxian (Dep. Chemical Physics, Univ. Sci. and Technology China, Hefei, 230026, Peop. Rep. China). Huaxue Wuli Xuebao, 10(3), 237-240 (Chinese) 1997. CODEN: HWXUE4. ISSN: 1003-7713. Publisher: Zhongguo Kexue Jishu Daxue Chubanshe.
- AB The highly dispersed **Mo2C** catalysts supported on charcoal were prepd. by temp-programmed carburization of precursor MoO2/C in CH4/H2 mixts. The effects of carburization temp., Mo-loading, passivation and H2-redn. on the surface properties were studied by XRD, XPS, CO uptake and sp. surface area measurements. The **Mo2C/C** catalysts prepd. at 680 °C had a high activity in **methanation**. After H2-redn. of these passivated catalysts at 600 °C, an O/Mo at. ratios of 0.4 .apprx. 0.5 and a preferential component of Mo4+ were obsd. on surface. Only a single peak of Cls was detected at 284.5 eV. The nature of active sites is discussed.
- IT 12069-89-5, **Molybdenum carbide (mo2c)**
(XPS study of **Mo2C** catalysts)
- RN 12069-89-5 HCA
- CN Molybdenum carbide (Mo2C) (8CI, 9CI) (CA INDEX NAME)
- *** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
- CC 67-1 (Catalysis, Reaction Kinetics, and Inorganic Reaction Mechanisms)
- ST **molybdenum carbide methanation**
catalyst XPS
- IT Carburizing
Methanation catalysts
(XPS study of **Mo2C** catalysts)
- IT 7440-44-0, Carbon, uses 12069-89-5, **Molybdenum carbide (mo2c)**

- (XPS study of **Mo2C** catalysts)
- IT 74-82-8, Methane, reactions 1333-74-0, Hydrogen, reactions
18868-43-4, Molybdenum dioxide
(XPS study of **Mo2C** catalysts)
- L28 ANSWER 5 OF 22 HCA COPYRIGHT 2004 ACS on STN
126:65961 Sonochemical preparation of nanostructured catalysts.
Suslick, Kenneth S.; Hyeon, Taeghwan; Fang, Mingming; Cichowlas,
Andrzej A. (School Chemical Sciences, University Illinois, Urbana,
IL, 61801, USA). Advanced Catalysts and Nanostructured Materials,
197-212. Editor(s): Moser, William R. Academic: San Diego, Calif.
(English) 1996. CODEN: 63URAA.
- AB A review with 40 refs. Sonochem. decompn. of volatile
organometallic precursors in high-boiling solvents produces
nanostructured materials in various forms with high catalytic
activities. Nanometer colloids, nanoporous high-surface-area
aggregates, and nanostructured oxide-supported catalysts can all be
prepd. by this general route. For example, sonication of iron
pentacarbonyl with silica generated supported amorphous
nanostructured Fe/SiO2 catalyst. The nanostructured Fe/SiO2
catalyst showed higher catalytic activity for **Fischer-**
Tropsch synthesis than the conventional Fe/silica catalyst
prepd. by the incipient wetness method. Sonochem. synthesis of
high-surface-area alloys can be accomplished by the sonolysis of
Fe(CO)5 and Co(CO)3(NO) to make nanostructured Fe and Co metals and
Fe-Co alloys. The sonochem. prep'd. Fe-Co alloys have large surface
areas relative to bulk metal even after heat treatment. We find
very high catalytic activity for these Fe, Co, and Fe-Co powders for
the dehydrogenation and hydrogenolysis of cyclohexane.
Surprisingly, the Fe-Co alloys show very high selectivities for
dehydrogenation. Other bimetallic catalysts that have been exam'd.
for dehydrogenation of cyclohexane often involved Pt; in these
cases, too, selectivity is improved in the alloys. Finally,
ultrasonic irradiation of molybdenum hexacarbonyl produces aggregates of
nanometer-sized clusters of face-centered cubic **molybdenum**
carbide. The material was extremely porous with a
high-surface area and consisted of aggregates of .apprx.2-nm-sized
particles. The catalytic properties showed that the
molybdenum carbide generated by ultrasound is an
active and highly selective dehydrogenation catalyst.
- CC 67-0 (Catalysis, Reaction Kinetics, and Inorganic Reaction
Mechanisms)
Section cross-reference(s): 29, 51, 55
- IT Hydrogenation catalysts
(**Fischer-Tropsch**; sonochem. prepn. of
nanostructured catalysts)
- L28 ANSWER 6 OF 22 HCA COPYRIGHT 2004 ACS on STN

- 125:90687 Nanostructured Materials Generated by High-Intensity Ultrasound: Sonochemical Synthesis and Catalytic Studies. Suslick, Kenneth S.; Hyeon, Taeghwan; Fang, Mingming (School of Chemical Sciences, University of Illinois, Urbana, IL, 61801, USA). Chemistry of Materials, 8(8), 2172-2179 (English) 1996. CODEN: CMATEX. ISSN: 0897-4756. Publisher: American Chemical Society.
- AB A review, with 47 refs., of the prepn. and properties of nanostructured catalysts by ultrasound treatment of precursors. The sonochem. decompn. of volatile organometallic compds. produces high-surface-area solids consisting of agglomerates of nanometer clusters. Nanostructured metals and alloys are formed from $\text{Fe}(\text{CO})_5$ and $\text{Co}(\text{CO})_3(\text{NO})$; the metal carbide was produced from $\text{Mo}(\text{CO})_6$. The Fe, Co, and Fe-Co alloys have high activity for cyclohexane dehydrogenation and hydrogenolysis; nanostructured Fe/SiO_2 (prepd. by ultrasound treatment of $\text{Fe}(\text{CO})_5\text{-SiO}_2$ slurry) was an active **Fischer-Tropsch** catalyst; and ultrasound irradiation of $\text{Mo}(\text{CO})_6$ produced aggregates of nanometer-sized clusters (.apprx.2 nm) of face-centered-cubic **Mo₂C**, with dehydrogenation activity comparable to that of com. ultrafine powd. Pt.
- IT 12069-89-5, **Molybdenum carbide (Mo₂C)**
(formation of, as hydrocarbon dehydrogenation catalyst; prepn. and properties of nanostructured catalysts by ultrasound treatment of precursors)
- RN 12069-89-5 HCA
- CN Molybdenum carbide (Mo₂C) (8CI, 9CI) (CA INDEX NAME)
- *** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
- CC 51-0 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 29, 67, 78
- ST review ultrasound nanostructure catalyst; petroleum refining catalyst nanostructure review; iron **Fischer-Tropsch** nanostructure catalyst review
- IT Hydrogenation catalysts
(**Fischer-Tropsch**; prepn. and properties of nanostructured catalysts by ultrasound treatment of $\text{Fe}(\text{CO})_5\text{-SiO}_2$ slurries)
- IT 12069-89-5, **Molybdenum carbide (Mo₂C)**
(formation of, as hydrocarbon dehydrogenation catalyst; prepn. and properties of nanostructured catalysts by ultrasound treatment of precursors)
- IT 630-08-0, Carbon monoxide, reactions
(hydrogenation of; prepn. and activity of nanostructured SiO_2 -supported Fe **Fischer-Tropsch** catalysts)
- IT 51881-84-6
(ultrafine; prepn. and activity of nanostructured SiO_2 -supported Fe **Fischer-Tropsch** catalysts)

L28 ANSWER 7 OF 22 HCA COPYRIGHT 2004 ACS on STN

124:293960 Molybdenum Hexacarbonyl as a Catalyst Precursor for Solvent-Free Direct Coal Liquefaction. Warzinski, Robert P.; Bockrath, Bradley C. (U.S. Department of Energy, Pittsburgh Energy Technology Center, Pittsburgh, PA, 15236, USA). Energy & Fuels, 10(3), 612-22 (English) 1996. CODEN: ENFUEM. ISSN: 0887-0624. Publisher: American Chemical Society.

AB The use of molybdenum hexacarbonyl was studied in solvent-free expts. The activity of the catalysts formed from Mo(CO)₆, both for liquefaction of a Blind Canyon bituminous coal and for **methanation** of CO in the absence of coal, was a function of activation conditions and reaction parameters.

CC 51-21 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 67

IT 630-08-0, Carbon monoxide, reactions
(**methanation** of; molybdenum hexacarbonyl as a catalyst precursor for)

IT 1317-33-5, Molybdenum disulfide, uses 12627-57-5,
Molybdenum carbide
(molybdenum hexacarbonyl as a catalyst precursor for solvent-free direct coal liquefaction)

L28 ANSWER 8 OF 22 HCA COPYRIGHT 2004 ACS on STN

124:67852 Sonochemical synthesis of nanostructured catalysts. Suslick, Kenneth S.; Hyeon, Taeghwan; Fang, Mingming; Cichowlas, Andrzej A. (School of Chemical Sciences and Materials Research Laboratory, University of Illinois at Urbana-Champaign, 505 S. Mathews Avenue, Urbana, IL, 61801, USA). Materials Science & Engineering, A: Structural Materials: Properties, Microstructure and Processing, A204(1-2), 186-92 (English) 1995. CODEN: MSAPE3. ISSN: 0921-5093. Publisher: Elsevier.

AB Sonochem. arises from acoustic cavitation; the formation, growth, and collapse of bubbles in a liq. The implosive collapse of a bubble generates a localized hot spot; a temp. of .apprx.5000 K and pressure of .apprx.1800 atm, with cooling rates that exceed 10⁹ K s⁻¹. Using these extreme conditions, we have developed a new synthetic technique for the synthesis of nanostructured inorg. materials. When irradiated with high intensity ultrasound in low volatility solvents under argon, volatile organometallic precursors produce high surface area solids that consist of agglomerates of nanometer clusters. These sonochem. produced nanostructured solids are active heterogeneous catalysts for hydrocarbon reforming and CO hydrogenation. For Fe and Co, nanostructured metals are formed; for Mo and W, metal carbides (e.g., **Mo₂C**) are produced. Using polymeric ligands (e.g., polyvinylpyrrolidone) or oxide supports (alumina or silica), the initially formed nanoscale clusters can be trapped as colloids or supported catalysts, resp.

IT 12069-89-5, **Molybdenum carbide**(

mo2c)

(sonochem. synthesis of nanostructured catalysts)

RN 12069-89-5 HCA

CN Molybdenum carbide (Mo2C) (8CI, 9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CC 67-1 (Catalysis, Reaction Kinetics, and Inorganic Reaction Mechanisms)

Section cross-reference(s): 51

ST sonochem synthesis nanostructured catalyst; **Fischer Tropsch** nanostructured catalyst sonochem synthesis; hydrocarbon reforming nanostructured catalyst sonochem synthesis

IT 1344-28-1, Alumina, uses 7439-89-6, Iron, uses 7440-48-4, Cobalt, uses 7631-86-9, Silica, uses 9003-39-8, Polyvinylpyrrolidone 11130-73-7, Tungsten carbide **12069-89-5, Molybdenum carbide** (**mo2c**) 12781-95-2

(sonochem. synthesis of nanostructured catalysts)

L28 ANSWER 9 OF 22 HCA COPYRIGHT 2004 ACS on STN

119:274738 Thermogravimetric study of the carburization and coking of unsupported and carbon-supported iron and molybdenum and Fe-Mo catalysts for **Fischer-Tropsch** synthesis. Liu, J.; Shen, J.; Gao, X.; Lin, L. (Dalian Inst. Chem. Phys., Chin. Acad. Sci., Dalian, 116011, Peop. Rep. China). Journal of Thermal Analysis, 40(3), 1239-44 (English) 1993. CODEN: JTAEA9. ISSN: 0368-4466.

AB The carburization of and coke deposition on unsupported and carbon-supported Fe, Mo and Fe-Mo catalysts in synthesis gas were studied by thermogravimetry in connection with **Fischer-Tropsch** synthesis. Compns. of the carbides formed were evaluated on the basis of the amt. of metals in the catalysts and amt. of carbon deposited during carburization. The carburization temp. and the nature of the carbides formed (Fe5C2 and Fe2C for Fe and **Mo2C** for Mo) were dependent on the choice of metals and were further influenced by the support and metal loading on the support. Coke deposition on these catalysts took place as soon as carburization was complete.

IT **12069-89-5P, Molybdenum carbide** (**Mo2C**)

(formation of, in carburization of molybdenum **Fischer-Tropsch** catalysts under growth conditions, coke deposition in relation to)

RN 12069-89-5 HCA

CN Molybdenum carbide (Mo2C) (8CI, 9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 67

ST **Fischer Tropsch** iron molybdenum catalyst

carburization; iron **Fischer Tropsch** catalyst
 carburization coking; molybdenum **Fischer Tropsch**
 catalyst carburization coking; carbide formation iron molybdenum
Fischer Tropsch

- IT Hydrogenation catalysts
 (iron and molybdenum, for **Fischer-Tropsch**
 reaction, carburization of, coke deposition and deactivation in
 relation to)
- IT Carburization
 (of iron and molybdenum **Fischer-Tropsch**
 catalysts, coke deposition and deactivation in relation to)
- IT Fuel gases
 (synthesis gas, carburization of iron and molybdenum catalysts in
 presence of, in **Fischer-Tropsch** reaction)
- IT 7439-89-6, Iron, uses 7439-98-7, Molybdenum, uses
 (catalysts, in **Fischer-Tropsch** reaction,
 carburization of, coke deposition and deactivation in relation
 to)
- IT 12011-66-4P, Iron carbide (Fe_2C) 12127-45-6P, Iron carbide (Fe_5C_2)
 (formation of, in carburization of iron **Fischer-**
Tropsch catalysts under growth conditions, coke
 deposition in relation to)
- IT 12069-89-5P, Molybdenum carbide (Mo_2C)
 (formation of, in carburization of molybdenum **Fischer-**
Tropsch catalysts under growth conditions, coke
 deposition in relation to)
- IT 7440-44-0P, Carbon, preparation
 (formation of, in deactivation of iron and molybdenum
Fischer-Tropsch catalysts, catalyst
 carburization in relation to)
- IT 630-08-0, Carbon monoxide, reactions
 (hydrogenation of, in **Fischer-Tropsch**
 reaction, iron and molybdenum catalysts for, carburization
 reactions in)

L28 ANSWER 10 OF 22 HCA COPYRIGHT 2004 ACS on STN

119:211594 Decomposition of molybdenum hexacarbonyl deposited on
 dehydroxylated alumina. Lee, Jae Sung; Boudart, Michel (Dep. Chem.
 Eng., Pohang Inst. Sci. Technol., Pohang, S. Korea). Japanese
 Journal of Applied Physics, Part 1: Regular Papers, Short Notes &
 Review Papers, 32(Suppl. 32-2, XAFS VII), 472-4 (English) 1993.
 CODEN: JAPNDE. ISSN: 0021-4922.

AB Deposition and decompn. of $\text{Mo}(\text{CO})_6$ on dehydroxylated alumina was
 studied by EXAFS. The rate of deposition and the structure of
 deposited species depended on deposition temp. At 320 K, the
 deposition rate was slow, and the species on the support was
 $\text{Mo}(\text{CO})_5$. The species formed at 360 K had an av. stoichiometry of

Mo(CO)_{2.5} without a well-defined structure. Heating of the deposited subcarbonyls in flowing H₂ caused first simple decarbonylation and then **methanation** above 450 K. Around 930 K, highly carbon-deficient **Mo₂C** was formed, which was converted to metallic Mo on further heating to 970 K.

CC 67-3 (Catalysis, Reaction Kinetics, and Inorganic Reaction Mechanisms)

Section cross-reference(s): 66

L28 ANSWER 11 OF 22 HCA COPYRIGHT 2004 ACS on STN

118:257791 Performance of iron-molybdenum/silicon dioxide bimetallic catalysts for **Fischer-Tropsch** synthesis. Shen, Jianyi; Lin, Liwu; Zhang, Su; Liang, Dongbai (Dalian Inst. Chem. Phys., Acad. Sin., Dalian, 116023, Peop. Rep. China). Cuihua Xuebao, 14(2), 81-6 (Chinese) 1993. CODEN: THHPD3. ISSN: 0253-9837.

AB The performance and structure characterization of Fe-Mo/SiO₂ catalysts for the **Fischer-Tropsch** (F-T) synthesis, prep'd. by impregnation of SiO₂ with aq. Fe(NO₃)₃ and H₃(PMo₁₂O₄₀), were studied. The Fe species after redn., carburization, and F-T reaction were det'd. by in-situ Moessbauer spectroscopy, and the catalyst reactivity were evaluated in a fixed-bed microreactor at 320° and 2.5 MPa synthesis gas. An Fe-Mo alloy formed from Mo-rich Fe-Mo/SiO₂ during redn. at 550° in H and converted into **Fe-Mo carbide** during the carburization at 300° in synthesis gas. In the reaction, **Fe-Mo carbide** was the main phase formed from Mo-rich catalysts, showing high activity and an av. selectivity of Fe and Mo supported on SiO₂. For Fe-rich Fe-Mo/SiO₂, redn. at 550° in H resulted in the formation of mainly Fe²⁺, as well as Fe-Mo alloy and α-Fe, which in turn were converted into Fe³⁺ and Fe carbide during carburization; in the reaction, Fe²⁺ and a small amt. of Fe carbide were the main phases, showing very low activity and a selectivity similar to that of Fe/SiO₂.

CC 51-11 (Fossil Fuels, Derivatives, and Related Products)

Section cross-reference(s): 67

ST bimetallic iron molybdenum **Fischer Tropsch**;
carburization iron molybdenum **Fischer Tropsch**;
alloy iron molybdenum **Fischer Tropsch**; carbide
iron molybdenum **Fischer Tropsch**

IT Hydrogenation catalysts

(iron-molybdenum, silica-supported, for **Fischer-Tropsch** reaction)

IT 7439-98-7, Molybdenum, uses

(catalysts, contg. iron, silica-supported, for **Fischer-Tropsch** reaction)

IT 7439-89-6, Iron, uses

(catalysts, contg. molybdenum, silica-supported, for

- Fischer-Tropsch** reaction)
- IT 630-08-0, Carbon monoxide, reactions
(hydrogenation of, in **Fischer-Tropsch**
reaction, silica-supported iron-molybdenum catalysts for)
- IT 12640-64-1, Iron carbide 12783-13-0 117449-02-2, Iron
molybdenum carbide
(in silica-supported iron-molybdenum catalysts, during
Fischer-Tropsch reaction)
- L28 ANSWER 12 OF 22 HCA COPYRIGHT 2004 ACS on STN
- 118:237243 Performance of activated carbon supported iron-molybdenum
catalysts for **Fischer-Tropsch** synthesis. Shen,
Jianyi; Lin, Liwu; Zhang, Su; Liang, Dongbai (Dalian Inst. Chem.
Phys., Acad. Sin., Dalian, 116023, Peop. Rep. China). Cuihua
Xuebao, 14(1), 7-11 (Chinese) 1993. CODEN: THHPD3. ISSN:
0253-9837.
- AB Fe-Mo catalysts supported on activated carbon (AC) are evaluated in
Fischer-Tropsch synthesis in a fixed-bed
microreactor, and the active phases of the catalysts are detd. by
in-situ Moessbauer spectroscopy. Fe favors the formation of higher
hydrocarbons, and Mo favors the formation of gaseous hydrocarbons.
The Fe-Mo/AC catalysts exhibit the properties of both Fe and Mo, and
the Fe-Mo/OC (oil palm-derived carbon) catalyst shows good activity
and selectivity for C2-5 gases. In the reaction, **Fe-Mo**
carbide is the active phase in Mo-enriched Fe-Mo/AC
catalysts, and the **Fe-Mo carbide** and Fe₂.2C are
the active phases in Fe-enriched Fe-Mo/AC catalysts.
- CC 51-6 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 67
- ST **Fischer Tropsch** synthesis iron molybdenum
catalyst; iron molybdenum hydrogenation catalyst carbon support;
Moessbauer spectroscopy iron molybdenum catalyst
- IT Hydrogenation catalysts
(iron-molybdenum on activated carbon , for carbon monoxide, for
Fischer-Tropsch synthesis)
- IT 7439-98-7, Molybdenum, uses
(catalysts, contg. iron, activated-carbon-supported, for
Fischer-Tropsch synthesis)
- IT 7439-89-6, Iron, uses
(catalysts, contg. molybdenum, activated-carbon-supported, for
Fischer-Tropsch synthesis)
- IT 127887-42-7, Iron carbide (Fe₂.2C)
(catalytic phase, in **Fischer Tropsch**
synthesis , over activated-carbon-supported iron-molybdenum
catalysts)
- IT 117449-02-2, Iron **molybdenum carbide**
(catalytic phase, in **Fischer Tropsch**
synthesis, over activated-carbon-supported iron-molybdenum

catalysts)

L28 ANSWER 13 OF 22 HCA COPYRIGHT 2004 ACS on STN

118:216078 Moessbauer spectroscopic studies on reduction and carburization of activated carbon supported iron-molybdenum catalysts for **Fischer-Tropsch** synthesis. Shen, Jianyi; Lin, Liwu; Berry, Frank J. (Dalian Inst. Chem. Phys., Acad. Sin., Dalian, 116023, Peop. Rep. China). Cuihua Xuebao, 14(1), 1-6 (Chinese) 1993. CODEN: THHPD3. ISSN: 0253-9837.

AB The redn. and carburization of activated carbon (AC) supported Fe-Mo catalysts (Fe-Mo/AC) for **Fischer-Tropsch** synthesis have been studied by in-situ Moessbauer spectroscopy. The catalysts were prepd. by co-impregnation of AC with an aq. soln. of Fe(NO₃)₃ and H₃[PMo₁₂O₄₀], and reduced in H₂ at different temps. Fe³⁺ in the catalysts was easily reduced to Fe⁰ via Fe²⁺, but the reoxidn. of the reduced iron species to Fe³⁺ occurred in the range of 400-450° owing to the thermal decompn. of the Keggin structure of phosphomolybdate. Fe and Mo in the catalysts were reduced to metallic state at 500° forming Fe-Mo alloy, which showed a singlet in its Moessbauer spectra with an isomer shift of -0.16 mm/s, and the followed carburization at 300° in synthesis gas converted the Fe-Mo alloy into Fe-Mo **carbide**, which showed a doublet with δ .apprx.0.17 mm/s and Δ .apprx.0.64 mm/s in Mossbauer spectra.

CC 51-6 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 67, 70

ST **Fischer Tropsch** synthesis catalyst Moessbauer spectroscopy; iron molybdenum catalyst redn carburization; molybdenum iron activated carbon supported catalyst

IT Hydrogenation catalysts
(iron-molybdenum, on activated carbon, for **Fischer-Tropsch** synthesis, redn. and carburization of, Moessbauer spectroscopy of)

IT Carburization
Reduction
(of iron-molybdenum catalysts, activated-carbon-supported , for **Fischer-Tropsch** synthesis, Moessbauer spectroscopy of)

IT 7439-98-7P, Molybdenum, uses
(catalysts, contg. iron, activated-carbon-supported, for **Fischer-Tropsch** synthesis, Moessbauer spectroscopy of redn. and carburization of)

IT 7439-89-6P, Iron, uses
(catalysts, contg. molybdenum, activated-carbon-supported, for **Fischer-Tropsch** synthesis, Moessbauer spectroscopy of redn. and carburization of)

IT 10421-48-4, Ferric nitrate 12026-57-2, Molybdophosphoric acid (H₃PMo₁₂O₄₀)

(precursor, for activated-carbon-supported iron-molybdenum catalysts for **Fischer-Tropsch** synthesis, Moessbauer spectroscopy of catalyst redn. and carburization in relation to)

L28 ANSWER 14 OF 22 HCA COPYRIGHT 2004 ACS on STN

104:132616 Report on the catalytic activity of 6-heteropolymolybdates as potential **Fischer-Tropsch** synthesis catalysts.

Dun, Jo Wei; Gulari, Erdogan; Streusand, Barry (Dep. Chem. Eng., Univ. Michigan, Ann Arbor, MI, 48109, USA). Applied Catalysis, 21(1), 61-72 (English) 1986. CODEN: APCADI. ISSN: 0166-9834.

AB Unsupported and supported decompn. products of 6-heteropolymolybdates were tested as possible **Fischer-Tropsch** synthesis catalysts. Depending on the heteroatom, activity changes significantly and the best support catalysts have higher activity (based on total metal loading) than previously investigated MoO₂ and **Mo₂C** catalysts.

CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 67

ST molybdate hydrogenation catalyst **Fischer Tropsch**

IT Hydrogenation catalysts
(heteropolymolybdates, for carbon monoxide, in **Fischer-Tropsch** synthesis)

IT 12139-65-0 12208-34-3 12428-25-0 12433-22-6 12528-95-9
55585-77-8 69081-30-7

(catalysts, for hydrogenation of carbon monoxide, in **Fischer-Tropsch** synthesis)

IT 124-38-9, reactions
(hydrogenation of, heteropolymolybdate catalysts for, in **Fischer-Tropsch** process)

L28 ANSWER 15 OF 22 HCA COPYRIGHT 2004 ACS on STN

101:94056 Catalysis by transition metal carbides. V. Kinetic measurements of hydrogenation of carbon monoxide over tantalum carbide, titanium carbide and **molybdenum carbide (Mo₂C)** catalysts. Kojima, Isao; Miyazaki, Eizo (Dep. Chem., Tokyo Inst. Technol., Tokyo, 152, Japan). Journal of Catalysis, 89(1), 168-71 (English) 1984. CODEN: JCTLA5. ISSN: 0021-9517.

AB CO was hydrogenated over TaC, TiC, or **Mo₂C** which had been activated in H₂. The main products were CH₄ [74-82-8] > H₂O > CO₂ > C₂H₄ [74-85-1]. The reaction is pressure dependent. The mechanism of direct CO hydrogenation best describes the process.

CC 51-11 (Fossil Fuels, Derivatives, and Related Products)

ST carbon monoxide **methanation** hydrogenation; tantalum carbide carbon monoxide hydrogenation; titanium carbide carbon monoxide hydrogenation; **molybdenum carbide** carbon monoxide hydrogenation; kinetics carbon monoxide

- hydrogenation
- IT Kinetics of **methanation**
(of carbon monoxide, transition metal carbides as catalysts for)
- IT Hydrogenation catalysts
Methanation catalysts
(transition metal carbides, for carbon monoxide)
- IT 12070-08-5 51680-51-4
(catalyst, carbon monoxide **methanation** over, kinetics of)
- IT 12627-57-5
(catalyst, carbon monoxide **methanation** over, kinetics of)
- L28 ANSWER 16 OF 22 HCA COPYRIGHT 2004 ACS on STN
- 97:219330 Reactions of carbon monoxide with hydrogen over molybdenum/charcoal catalysts. Bridgewater, A. J.; Burch, R.; Mitchell, P. C. H. (Dep. Chem., Univ. Reading, Whiteknights/Reading, RG6 2AD, UK). Journal of Catalysis, 78(1), 116-25 (English) 1982. CODEN: JCTLA5. ISSN: 0021-9517.
- AB Mo/C catalysts have been prepd. and characterized and their activities and selectivities detd. for CO-H reactions at 573-673 K and 0.16-1.6 MPa. The catalysts were activated either by calcination under N at 773 K followed by heating in H at 773 K (forming MoO₂ as the major phase), or by redn. in H at 1073 K (resulting in **Mo₂C**). The activities and selectivities of the MoO₂/C and **Mo₂C**/C catalysts are comparable. K, either as an impurity or a promoter, seriously poisoned both types of catalyst. The catalysts have high activity and stability in comparison with literature data, but are very susceptible to poisoning by impurities.
- IT 12069-89-5P
(**methanation** catalysts, on charcoal, for carbon monoxide, prepn. and characterization of)
- RN 12069-89-5 HCA
- CN Molybdenum carbide (Mo₂C) (8CI, 9CI) (CA INDEX NAME)
- *** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
- CC 51-21 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 67
- ST molybdenum charcoal **methanation** catalyst; carbide
molybdenum charcoal **methanation** catalyst; potassium
poisoning molybdenum charcoal **methanation**; oxide
molybdenum charcoal **methanation** catalyst
- IT **Methanation** catalysts
(molybdenum-charcoal, prepn. and characterization of)
- IT Charcoal
(coconut, support, for molybdenum **methanation** catalysts)
- IT 12069-89-5P 18868-43-4P

- (**methanation** catalysts, on charcoal, for carbon monoxide, prepn. and characterization of)
- IT 7439-98-7P, uses and miscellaneous
(**methanation** catalysts, on charcoal, prepn. and characterization of)
- L28 ANSWER 17 OF 22 HCA COPYRIGHT 2004 ACS on STN
97:9026 A supported **molybdenum carbide** composition.
Slaugh, Lynn H.; Hoxmeier, Ronald J. (Shell Oil Co., USA). U.S. US
4326992 A 19820427, 4 pp. (English). CODEN: USXXAM. APPLICATION:
US 1980-213972 19801208.
- AB Supported **Mo2C** is prepd. by impregnation of a porous
support with MoO3 in aq. NH4OH, drying the impregnated support, and
heating in 90:8:2 Ar-H-CH4 at 650-750°. The compn. has good
methanation activity at high temps. compared with supported
Mo.
- IT 12069-89-5P
(**methanation** catalyst, supported, for carbon monoxide,
prepn. and activity of)
- RN 12069-89-5 HCA
CN Molybdenum carbide (Mo2C) (8CI, 9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
IC B01J023-28; B01J027-22
NCL 252443000
CC 51-21 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 67
ST **molybdenum carbide methanation**
catalyst; methane **molybdenum carbide** catalyst
- IT **Methanation** catalysts
(**molybdenum carbide**, for carbon monoxide,
supported, prepn. and activity of)
- IT 74-82-8P, preparation
(manuf. of, by carbon monoxide hydrogenation, on supported
molybdenum carbide)
- IT 12069-89-5P
(**methanation** catalyst, supported, for carbon monoxide,
prepn. and activity of)
- IT 630-08-0, reactions
(**methanation** of, catalysts for)
- L28 ANSWER 18 OF 22 HCA COPYRIGHT 2004 ACS on STN
96:165318 Thermally stable nickel-molybdenum alloy catalysts supported
on magnesium aluminate for high temperature **methanation**.
Araki, Michio; Takaya, Haruo; Ogawa, Kiyoshi; Suzuki, Kunio; Hosoya,
Tadasuke; Todo, Naoyuki (Natl. Chem. Lab. Ind., Ibaraki, 305,
Japan). Sekiyu Gakkaishi, 25(2), 87-93 (English) 1982. CODEN:
SKGSAE. ISSN: 0582-4664.
- AB High-temp. (>350°) Ni-Mo alloy **methanation**

catalysts are prep'd. by H redn. at 700° (for 15 h) of 20 wt.% NiO-25 wt.% MoO₃/MgAl₂O₄. Stable activity was obs'd. at 650° and 80 kg/cm² through 12 days (space velocity 15,000/h with a feed contg. CO 15, H 45, and CH₄ 40%), in comparison with Ni-Mo alloy catalysts supported on MgO or α - and γ -Al₂O₃. The differences in thermal stabilities were attributed to a resistance to sintering of Ni-Mo crystallites and lower Mo₂C contents on MgAl₂O₄.

CC 51-21 (Fossil Fuels, Derivatives, and Related Products)

Section cross-reference(s): 67

ST high temp **methanation** catalyst; nickel molybdenum

methanation catalyst; carbon monoxide **methanation**

catalyst; aluminate nickel molybdenum **methanation** support;

alloy catalyst nickel molybdenum **methanation**

IT **Methanation** catalysts

(nickel-molybdenum, for carbon monoxide at high temp., thermal stability of)

IT Sintering

(of nickel-molybdenum high-temp. **methanation** catalyst, support in relation to)

IT 7439-98-7, uses and miscellaneous 7440-02-0, uses and miscellaneous 12068-51-8

(catalyst contg., for high-temp. **methanation** of carbon monoxide)

IT 630-08-0, reactions

(**methanation** of, at high temp., catalyst for)

L28 ANSWER 19 OF 22 HCA COPYRIGHT 2004 ACS on STN

96:70767 Methane synthesis catalyst. (Agency of Industrial Sciences and Technology, Japan). Jpn. Kokai Tokkyo Koho JP 56108538 A2 19810828 Showa, 4 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1980-11734 19800201.

AB A porous support contg. NiO and MoO₃ is heated in a gas contg. H and CO 500-800°, with or without preheating in H at 400-900°, to prep. a catalyst, contg. NiMo alloy and

Mo carbide, which is useful for the prepn. of CH₄

[74-82-8]. Thus, porous Al₂O₃ (calcined at 1000°), Ni(NO₃)₂,

and ammonium paramolybdate were kneaded to give a 55:20:25

Al₂O₃-NiO-MoO₃ ratio, heated at 700° in H, carburized at

650° and 80 kg/cm² in a 45:15:40 H-CO-CH₄ stream for 12 h,

and used for the manuf. of CH₄, giving a CH₄ content of 62% after 10 days. A com. Ni catalyst was inactive after one day.

IC B01J027-22; C07C001-04; C07C009-04

CC 45-4 (Industrial Organic Chemicals, Leather, Fats, and Waxes)

Section cross-reference(s): 23

IT **Methanation** catalysts

(molybdenum trioxide-nickel oxide, for carbon monoxide)

L28 ANSWER 20 OF 22 HCA COPYRIGHT 2004 ACS on STN

96:38220 Methane production catalyst. (Agency of Industrial Sciences and Technology, Japan). Jpn. Kokai Tokkyo Koho JP 56124444 A2 19810930 Showa, 5 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1980-28877 19800306.

AB A Ni-Mo alloy- and **Mo carbide**-contg.

methanation catalyst was manufd. by treating NiO-MoO₃/MgO-Al₂O₃ with a gas contg. H and CO at 500-800° (sometimes after redn. in H at 400-900°). Thus, aq. Mg(NO₃)₂-Al(NO₃)₃ (Mg-Al (at.) 0.5:1) was pptd. with (NH₄)₂CO₃. The ppt. was calcined at 500° and kneaded with aq. Ni(NO₃)₂ and NH₄ paramolybdate to give a NiO-MoO₃-support ratio 20:25:55. A 2-mL portion was heated in H at 700° for 15 h and treated with H-CO-CH₄ (45:15:40) at 650° and 80 kg/cm² for 12 h. In expts. conducted at 400°, the CH₄ content of the product was .apprx.75% after 9 days, compared with 65% and 55%, resp., for catalysts supported on Al₂O₃ calcined at 1000° or on SiO₂.

IC B01J027-22; C07C001-04; C07C009-04

CC 51-21 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 67

ST **methanation** catalysts nickel molybdenum; methane prodn
nickel molybdenum

IT Natural gas, substitute
(manuf. of, by **methanation** of carbon monoxide,
catalysts for)

IT **Methanation** catalysts
(molybdenum-nickel, contg. alumina, for carbon monoxide)

IT 7440-02-0, uses and miscellaneous
(catalysts, contg. molybdenum and alumina, for
methanation of carbon monoxide)

IT 7439-98-7, uses and miscellaneous
(catalysts, contg. nickel and alumina, for **methanation**
of carbon monoxide)

L28 ANSWER 21 OF 22 HCA COPYRIGHT 2004 ACS on STN

95:206503 Heat-resistance of nickel-**molybdenum carbide**
catalysts for **methanation**. Takaya, H.; Araki, M.; Shin,
S.; Suzuki, K.; Hosoya, T.; Ogawa, K.; Todo, N. (Tsukuba Res. Cent.,
Natl. Chem. Lab. Ind., Ibaraki, 305, Japan). Studies in Surface
Science and Catalysis, 7(Pt. B, New Horiz. Catal.), 1442-3 (English)
1981. CODEN: SSCTDM. ISSN: 0167-2991.

AB Five Ni-**Mo carbide** catalysts had good thermal
stability in **methanation** at 650°, 80 kg/cm², and
space velocity 15,000 h⁻¹.

CC 51-29 (Fossil Fuels, Derivatives, and Related Products)

ST nickel **molybdenum carbide methanation**;
catalyst nickel **methanation** stability; thermal stability
methanation catalyst

- IT **Methanation** catalysts
(nickel-molybdenum carbide, thermal stability of)
- IT 7440-02-0, uses and miscellaneous
(catalysts, contg. molybdenum carbide, for methanation, thermal stability of)
- IT 12627-57-5
(catalysts, contg. nickel, for methanation, thermal stability of)
- L28 ANSWER 22 OF 22 HCA COPYRIGHT 2004 ACS on STN
- 92:11699 Synthesis of new catalytic materials: metal carbides of the Group VI B elements. Leclercq, L.; Imura, K.; Yoshida, S.; Barbee, T.; Boudart, M. (Dep. Chem. Eng., Stanford Univ., Stanford, CA, 94305, USA). Studies in Surface Science and Catalysis, 3(Prep. Catal. 2), 627-39 (English) 1979. CODEN: SSCTDM. ISSN: 0167-2991.
- AB **Mo carbide** (esp. Mo oxycarbide) and W carbide were studied in relation to their use as catalysts, esp. for CO hydrogenation to hydrocarbons and for CO **methanation**. The studies included chemisorption of CO by the carbides, prepn. of Mo oxycarbide from Mo(CO)₆, carburization of Mo oxycarbide to increase catalytic activity close to that of Ru, graphite-induced inactivation of WC surface for H chemisorption, etc.
- CC 67-1 (Catalysis and Reaction Kinetics)
- ST carbide catalyst **methanation** hydrocarbon prepn; **molybdenum carbide** catalyst **methanation** hydrogenation; tungsten carbide catalyst; carbon monoxide hydrogenation catalyst carbide
- IT Catalysts and Catalysis
(**molybdenum carbide** and tungsten carbide)
- IT Hydrogenation catalysts
Methanation catalysts
(**molybdenum carbide** and tungsten carbide, for carbon monoxide)
- IT Chemisorption
(of carbon monoxide, by **molybdenum carbide** and tungsten carbide catalysts)
- IT Hydrocarbons, preparation
(prepn. of, from carbon monoxide, **molybdenum carbide** and tungsten carbide catalysts for)
- IT 11130-73-7 12627-57-5 13939-06-5
(catalysts, for hydrocarbon prepn., hydrogenation of carbon monoxide, and **methanation**)
- IT 13939-06-5
(decompn. of, **molybdenum carbide** oxide catalysts formed by)
- IT 630-08-0, reactions
(hydrogenation of, **molybdenum carbide** and

tungsten carbide catalysts for)

=> d 129 1-27 cbib abs hitstr hitind

L29 ANSWER 1 OF 27 HCA COPYRIGHT 2004 ACS on STN

140:113840 The effect of **Mo2C** synthesis and pretreatment on catalytic stability in oxidative reforming environments. LaMont, David C.; Gilligan, Andrew J.; Darujati, Anna R. S.; Chellappa, Anand S.; Thomson, William J. (Department of Chemical Engineering, Washington State University, Pullman, WA, 99164-2710, USA). Applied Catalysis, A: General, 255(2), 239-253 (English) 2003. CODEN: ACAGE4. ISSN: 0926-860X. Publisher: Elsevier Science B.V..

AB The role of catalyst pretreatment on the stability of **Mo2C** catalysts in oxidative reforming environments has been studied. Catalysts were produced by both the temp. programmed reaction (TPR) and a soln.-derived (SD) synthesis method, and compared to a low surface area com. catalyst. Using a variety of techniques, including in situ dynamic X-ray diffraction (DXRD), the effects of various hydrogen pretreatment protocols were evaluated, including catalyst thermal stability, oxidn. resistance and susceptibility to coking. The high surface areas produced by the SD synthesis is attributed to the presence of excess synthesis carbon and, whereas the presence of excess synthesis carbon enhances thermal stability, it also appears to accelerate coking. It is pointed out that the lowered oxidn. resistance of the high surface area catalysts is due to a combination of smaller crystallite sizes and competitive oxidn. of the excess synthesis carbon, which alters the oxidn. mechanism. In addn., it was also found that incomplete carburization during TPR synthesis, forms an oxycarbide and its acidity also promotes coking. Hydrogen pretreatment at 700 °C not only removes all excess synthesis carbon, but it also reduces the oxycarbide to Mo, which is easily carburized under reforming conditions. Pretreatment at 600 °C, was largely ineffective and it is concluded that high temp. pretreatment is necessary to form the stoichiometric carbide, which is required for stability during reforming. Both the TPR and SD catalysts pretreated at 700 °C, were found to be stable over a 72 h period, whereas the com. carbide had almost identical activity but slowly deactivated over the same period, probably because of its low surface area. Finally, labeled isotope expts. revealed that carbon exchange occurs readily with bulk **Mo2C** at temps. above 550 °C, lending credence to a reforming redox mechanism.

IT 12069-89-5P, Molybdenum carbide (**Mo2C**)

(effect of **Mo2C** synthesis and pretreatment on catalytic stability in oxidative reforming environments)

RN 12069-89-5 HCA

- CN Molybdenum carbide (Mo₂C) (8CI, 9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
ST carbon dioxide **methane reforming**
molybdenum carbide catalyst prepn stability
IT Carburizing
Reforming catalysts
Synthesis gas manufacturing
(effect of **Mo₂C** synthesis and pretreatment on catalytic stability in oxidative reforming environments)
IT Reaction mechanism
(of dry **methane reforming**; effect of **Mo₂C** synthesis and pretreatment on catalytic stability in oxidative reforming environments)
IT **Reforming**
(of **methane**; effect of **Mo₂C** synthesis and pretreatment on catalytic stability in oxidative reforming environments)
IT Redox reaction
(reforming redox mechanism; effect of **Mo₂C** synthesis and pretreatment on catalytic stability in oxidative reforming environments)
IT Reduction
(thermal, temp.-programmed, temp. programmed redn.; effect of **Mo₂C** synthesis and pretreatment on catalytic stability in oxidative reforming environments)
IT **12069-89-5P, Molybdenum carbide (Mo₂C)**
(effect of **Mo₂C** synthesis and pretreatment on catalytic stability in oxidative reforming environments)
IT 7440-44-0, Carbon, reactions
(effect of **Mo₂C** synthesis and pretreatment on catalytic stability in oxidative reforming environments)
IT 74-82-8, Methane, reactions
(effect of **Mo₂C** synthesis and pretreatment on catalytic stability in oxidative reforming environments)
- L29 ANSWER 2 OF 27 HCA COPYRIGHT 2004 ACS on STN
140:61296 Promotional role of water added to methane feed on catalytic performance in the methane dehydroaromatization reaction on Mo/HZSM-5 catalyst. Liu, Shenglin; Ohnishi, Ryuichiro; Ichikawa, Masaru (Catalysis Research Center, Hokkaido University, Sapporo, 060-0811, Japan). Journal of Catalysis, 220(1), 57-65 (English) 2003. CODEN: JCTLA5. ISSN: 0021-9517. Publisher: Elsevier Science.
AB The addn. of a few percent of water to methane feed significantly improved catalytic performance in the methane dehydroaromatization reaction on 6 wt% Mo/HZSM-5 catalysts at 0.3 MPa and 998-1073 K.

Exactly three times as much hydrogen as CO was produced from H₂O and **methane**, suggesting that the **reforming** reaction was accompanied with the dehydrocondensation reaction of methane. However, addn. of water above 2.6% resulted in a sudden drop of catalytic activity after several hours of time on stream. Coke, a main inhibitor of the reaction, was produced a lesser amt. with increasing water concn. in methane feed. The HZSM-5 structure of Mo/HZSM-5 examd. by XRD and 27Al-MAS-NMR techniques remains intact even after the reaction at 1073 K in the presence of water except for a high water concn. of 2.6%, where framework aluminum migrates to extra framework positions, which may be responsible for the sudden drop of the catalytic activity. Small **Mo₂C** clusters, an active species of the reaction, were always obsd. on used catalysts by EXAFS anal. Stabilities of **Mo₂C** and C in a water atm. were estd. from equil. calcns. and discussed in conjunction with the reactivity of coke formed on the catalyst during the methane dehydroaromatization reaction. Based on the above results, the sudden drop of catalytic activity at an excess addn. of water may be explained by the two consecutive reactions of CH₄=C+2H₂ and C+H₂O=CO+H₂ (reforming reaction as a whole). These two consecutive reactions proceed whenever coke is present on the catalyst but not on the catalyst having no coke. Therefore, water can pass through on the catalyst having no coke and eventually almost all aluminum atoms in the lattice position move out by the action of water. Then, the catalyst can not promote the reforming reaction and also the dehydrocondensation reaction of methane.

CC 45-4 (Industrial Organic Chemicals, Leather, Fats, and Waxes)
Section cross-reference(s): 67

IT 12627-57-5, **Molybdenum carbide**

(stability of; promotional role of water added to methane feed on catalytic performance in the methane dehydroaromatization reaction on Mo/HZSM-5 catalyst)

L29 ANSWER 3 OF 27 HCA COPYRIGHT 2004 ACS on STN

140:48322 Mass spectrometric study of catalysts and catalysis. Nagai, Masatoshi (Graduate School of Bio-applications and Systems Engineering, Tokyo University of Agriculture and Technology, (2-24-16 Nakamachi Koganei, Tokyo, 184-8588, Japan). Journal of the Mass Spectrometry Society of Japan, 51(1), 279-280 (Japanese) 2003. CODEN: JMSJEY. ISSN: 1340-8097. Publisher: Nippon Shitsuryo Bunseki Gakkai.

AB A review on the surface reactivity of **molybdenum carbide** catalysts used in **methane reforming**, investigated by temp. programmed surface reaction-mass spectrometry (TPSR-MS).

CC 67-0 (Catalysis, Reaction Kinetics, and Inorganic Reaction Mechanisms)

IT 12627-57-5, **Molybdenum carbide**

(mass spectrometric study of catalysts and catalysis)

L29 ANSWER 4 OF 27 HCA COPYRIGHT 2004 ACS on STN

139:383703 Effects of co-fed O₂ and CO₂ on the deactivation of Mo/HZSM-5 for methane aromatization. Tan, P. L.; Wong, K. W.; Au, C. T.; Lai, S. Y. (Department of Chemistry and Center for Surface Analysis and Research, Hong Kong Baptist University, Kowloon Tong, Hong Kong). Applied Catalysis, A: General, 253(1), 305-316 (English) 2003. CODEN: ACAGE4. ISSN: 0926-860X. Publisher: Elsevier Science B.V..

AB The aromatization of methane in the presence of H₂, CO and CO₂ over a 2 wt.% Mo/HZSM-5 catalyst was studied. The results were compared with those for the aromatization reaction in pure methane and with added O₂. The addn. of O₂ up to 5.3% or CO₂ up to 12.8% reduces deactivation so that, at the reaction temp. of 770 °C, an arom. yield of ca. 4% can be maintained for 6 h; in the absence of the gaseous additive, however, the catalyst would have been completely deactivated for arom. formation within 4 h. XPS anal. revealed that, in the presence of O₂ or CO₂, the molybdenum oxide supported on the HZSM-5 located at the reactor inlet was not converted to **molybdenum carbide**, whereas in the zone away from the reactor inlet, **Mo₂C** was found. Investigation by temp.-programmed surface reaction showed that the prodn. of arom. compds. was always preceded by the reaction of molybdenum oxide with methane to form **Mo₂C** and CO. The beneficial effect of adding CO₂ and O₂ in low concn. was mainly attributed to the formation of CO and H₂ by oxidn. and the **reforming of methane** in the zone closed to the reactor inlet. H₂ enhances the stability of the catalyst by suppressing the excessive dehydrogenation of the reaction intermediates into inactive entities. When the concn. of CO₂ and O₂ was too high, the entire catalyst bed remained oxidized and the methane aromatization reaction could not occur.

IT 12069-89-5, **Molybdenum carbide** (**Mo₂C**)

(effects of co-feeding O₂ and CO₂ on the deactivation of Mo/HZSM-5 for methane aromatization)

RN 12069-89-5 HCA

CN Molybdenum carbide (Mo₂C) (8CI, 9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 45

IT 12069-89-5, **Molybdenum carbide** (**Mo₂C**)

(effects of co-feeding O₂ and CO₂ on the deactivation of Mo/HZSM-5 for methane aromatization)

L29 ANSWER 5 OF 27 HCA COPYRIGHT 2004 ACS on STN

139:339806 **Methane reforming on molybdenum**

carbide on Al-FSM-16. Nagai, Masatoshi; Nishibayashi, Toshihiro; Omi, Shinzo (Graduate School of Bio-applications and Systems Engineering, Tokyo University of Agriculture and Technology, Koganei, Tokyo, 184-8588, Japan). *Studies in Surface Science and Catalysis*, 146 (Nanotechnology in Mesosstructured Materials), 729-732 (English) 2003. CODEN: SSCTDM. ISSN: 0167-2991. Publisher: Elsevier Science B.V..

- AB **Methane reforming** on the carbided 12% Mo/Al-FSM-16 catalysts with Si/Al ratios of 30, 50, and 80 was performed at 973 K under atm. pressure. The characterization was carried out by N₂ adsorption, XRD, and 27Al MAS NMR. Al-FSM-16 with a Si/Al ratio of 30 exhibited an implantation of aluminum into the SiO₂ structure of FSM-16. The 873 K-carbided 12% Mo/Al-FSM-16 catalyst was more active than the oxidized catalyst and the catalysts carbided at a higher carbiding temp. The largest amts. of hydrogen and benzene were formed using the catalyst with the Si/Al ratio of 80. β - Mo₂C on the catalyst was formed during the carbiding and **methane reforming**.
- IT 12069-89-5, Molybdenum carbide (Mo₂C)
(methane reforming on molybdenum carbide/Al-FSM-16)
- RN 12069-89-5 HCA
- CN Molybdenum carbide (Mo₂C) (8CI, 9CI) (CA INDEX NAME)
- *** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
- CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 45, 49
- ST **methane reforming** catalyst hydrogen benzene prepn
- IT **Reforming** catalysts
(methane reforming on molybdenum carbide/Al-FSM-16)
- IT 7631-86-9, FSM-16, uses
(aluminated; **methane reforming** on molybdenum carbide/Al-FSM-16)
- IT 1313-27-5, Molybdena, uses
(carbiding of; **methane reforming** on molybdenum carbide/Al-FSM-16)
- IT 12069-89-5, Molybdenum carbide (Mo₂C)
(methane reforming on molybdenum carbide/Al-FSM-16)
- IT 74-82-8, **Methane**, reactions
(methane reforming on molybdenum carbide/Al-FSM-16)
- IT 71-43-2P, Benzene, preparation 1333-74-0P, Hydrogen, preparation
(methane reforming on molybdenum carbide/Al-FSM-16)

L29 ANSWER 6 OF 27 HCA COPYRIGHT 2004 ACS on STN

139:180364 CO₂ reforming of propane over supported Rh. Solymosi, F.; Tolmactsov, P.; Kedves, K. (Institute of Solid State and Radiochemistry, Reaction Kinetics Research Group of the Hungarian Academy of Sciences, University of Szeged, Szeged, H-6701, Hung.). Journal of Catalysis, 216(1-2), 377-385 (English) 2003. CODEN: JCTLA5. ISSN: 0021-9517. Publisher: Elsevier Science.

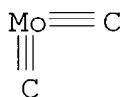
AB The adsorption, decompn., and reaction of propane with CO₂ have been investigated on Rh catalysts, deposited on various supports. The strong interaction of propane with Rh was noticed above 273 K. By means of Fourier transform IR spectroscopy, π -bonded propylene, di- σ -bonded propylene, and propylidyne have been identified. Propane underwent dehydrogenation and cracking on supported Rh at 824-923 K. Propylene formed with a selectivity of 50-60%. The other major products were ethylene and methane. The deposition of carbonaceous species was also obsd., the hydrogenation of which occurred only above 700-750 K, with a peak temp. of 900-950 K. The amt. of carbon was more than one order of magnitude higher than that of surface Rh atoms, suggesting its diffusion from the Rh onto the support. The presence of CO₂ basically altered the reaction pathway of propane, and the formation of H₂ and CO with a ratio of 0.42-0.59 came into prominence. Propylene was detected only in traces. This led to the assumption that propylene reacted quickly with CO₂ over Rh after its formation. This idea was confirmed by sep. study of the reaction of propylene with CO₂. Taking into account the rates of decompn. of propane and CO₂ on Rh catalysts, as well as the reaction orders, we came to the conclusion that the CO₂ is involved in the rate-detg. step of the dry reforming of propane. The highest specific rates for the prodn. of H₂ and CO were measured for Rh/TiO₂; this was explained by the extended dissocn. of CO₂ due to the electronic interaction between Rh and TiO₂.

IT **12122-47-3, Molybdenum carbide (MoC₂)**

(CO₂ reforming of propane over supported Rh)

RN 12122-47-3 HCA

CN Molybdenum carbide (MoC₂) (6CI, 7CI, 8CI, 9CI) (CA INDEX NAME)



CC 35-2 (Chemistry of Synthetic High Polymers)
Section cross-reference(s): 45, 67

IT 10049-07-7, Rhodium trichloride **12122-47-3, Molybdenum carbide (MoC₂)**

(CO₂ reforming of propane over supported Rh)

IT 74-82-8P, **Methane**, preparation 74-85-1P, Ethylene,

preparation 85056-54-8P, Propylidyne
(CO2 **reforming** of propane over supported Rh)

L29 ANSWER 7 OF 27 HCA COPYRIGHT 2004 ACS on STN

138:403872 Marked difference of catalytic behavior by preparation
methods in **CH4 reforming** with CO2 over

Mo2C and WC catalysts. Naito, Shuichi; Tsuji, Miyuki;
Sakamoto, Yousuke; Miyao, Toshihiro (Department of Applied
Chemistry, Faculty of Engineering, Kanagawa University, Kanagawa-ku,
Yokohama, 221-8686, Japan). Studies in Surface Science and
Catalysis, 143(Scientific Bases for the Preparation of Heterogeneous
Catalysts), 415-423 (English) 2002. CODEN: SSCTDM. ISSN:
0167-2991. Publisher: Elsevier Science B.V..

AB Dependence of the activity and durability upon the prepn. methods
was investigated in the **reforming** of **CH4** with
CO2 over molybdenum and tungsten carbide catalysts. It was found
that deactivation of **Mo2C** was suppressed even at ambient
pressure over catalysts prepd. through nitridation of molybdenum
oxides before carburization. On the contrary, in the case of WC the
catalysts prepd. through nitridation exhibited much lower durability
against the oxidn. of carbide during CH4-CO2 reaction than those
prepd. by direct carburization.

IT 12069-89-5P, Molybdenum carbide (
Mo2C)

(marked difference of catalytic behavior by prepn. methods in
CH4 reforming with CO2 over **Mo2C** and
WC catalysts)

RN 12069-89-5 HCA

CN Molybdenum carbide (**Mo2C**) (8CI, 9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CC 51-11 (Fossil Fuels, Derivatives, and Related Products)

ST carbon dioxide **methane reforming** catalyst
molybdenum tungsten carbide

IT Reforming catalysts

(marked difference of catalytic behavior by prepn. methods in
CH4 reforming with CO2 over **Mo2C** and
WC catalysts)

IT Carburizing

Nitriding

Synthesis gas manufacturing

(prepn. and durability of molybdenum and tungsten carbide
catalysts in **methane reforming** with carbon
dioxide)

IT 12069-89-5P, Molybdenum carbide (
Mo2C) 12070-12-1P, Tungsten carbide

(marked difference of catalytic behavior by prepn. methods in
CH4 reforming with CO2 over **Mo2C** and
WC catalysts)

- IT 124-38-9, Carbon dioxide, reactions
(prepn. and durability of molybdenum and tungsten carbide catalysts in **methane reforming** with)
- IT 74-82-8, Methane, reactions
(prepn. and durability of molybdenum and tungsten carbide catalysts in **methane reforming** with carbon dioxide)
- L29 ANSWER 8 OF 27 HCA COPYRIGHT 2004 ACS on STN
- 138:240266 Mechanistic difference of the CO2 **reforming** of CH4 over unsupported and zirconia- supported **molybdenum carbide** catalysts. Naito, Shuichi; Tsuji, Miyuki; Miyao, Toshihiro (Department of Applied Chemistry, Faculty of Engineering, Kanagawa University, 3-27-1, Rokkakubashi, nagawa-ku, Yokohama, 221-8686, Japan). Catalysis Today, 77(3), 161-165 (English) 2002. CODEN: CATTEA. ISSN: 0920-5861. Publisher: Elsevier Science B.V..
- AB Zirconia supported **molybdenum carbide** catalysts exhibited much higher activity for CH4-CO2 reaction than unsupported **Mo2C**. By lowering the loading amt. on ZrO2, deactivation was suppressed completely under the reaction condition of higher CH4/CO2 ratios and excellent activity was maintained. Transmission electron microscopic observation as well as XPS anal. demonstrated that **molybdenum carbide** was highly dispersed on ZrO2 with strong electronic interaction. Isotopic exchange reaction between CH4 and CD4 showed that the dissocn. of methane was significantly retarded by supporting **Mo2C** on ZrO2, which could be the main reason of high activity and durability of supported catalysts.
- IT 12069-89-5, **Molybdenum carbide** (**Mo2C**)
(mechanistic difference between CO2 **reforming** of **methane** over unsupported and zirconia- supported **molybdenum carbide** catalysts)
- RN 12069-89-5 HCA
- CN Molybdenum carbide (Mo2C) (8CI, 9CI) (CA INDEX NAME)
- *** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
- CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
- ST CO2 **reforming** catalyst **methane** zirconia support **molybdenum carbide**; reforming catalyst characterization TEM XPS EDX XRD zirconia support
- IT Catalyst supports
(effect on reaction mechanism; mechanistic difference between CO2 **reforming** of **methane** over unsupported and zirconia- supported **molybdenum carbide** catalysts)
- IT Exchange reaction
Exchange reaction kinetics

- Reforming kinetics
(mechanistic difference between CO2 **reforming** of **methane** over unsupported and zirconia- supported **molybdenum carbide** catalysts)
- IT Carburizing
(of molybdenum oxide phase; mechanistic difference between CO2 **reforming** of **methane** over unsupported and zirconia- supported **molybdenum carbide** catalysts)
- IT Synthesis gas manufacturing
(reforming synthesis gas manufg.; mechanistic difference between CO2 **reforming** of **methane** over unsupported and zirconia- supported **molybdenum carbide** catalysts)
- IT 18868-43-4, Molybdenum oxide (MoO₂)
(formed on catalyst; mechanistic difference between CO2 **reforming** of **methane** over unsupported and zirconia- supported **molybdenum carbide** catalysts)
- IT 12069-89-5, Molybdenum carbide (Mo₂C)
(mechanistic difference between CO2 **reforming** of **methane** over unsupported and zirconia- supported **molybdenum carbide** catalysts)
- IT 1313-27-5P, Molybdenum oxide (MoO₃), uses
(mechanistic difference between CO2 **reforming** of **methane** over unsupported and zirconia- supported **molybdenum carbide** catalysts)
- IT 630-08-0P, Carbon monoxide, preparation
(mechanistic difference between CO2 **reforming** of **methane** over unsupported and zirconia- supported **molybdenum carbide** catalysts)
- IT 1333-74-0P, Hydrogen, preparation
(mechanistic difference between CO2 **reforming** of **methane** over unsupported and zirconia- supported **molybdenum carbide** catalysts)
- IT 74-82-8, Methane, reactions 124-38-9, Carbon dioxide, reactions
(mechanistic difference between CO2 **reforming** of **methane** over unsupported and zirconia- supported **molybdenum carbide** catalysts)
- IT 676-49-3P, Methane (CH₃D)
(mechanistic difference between CO2 **reforming** of **methane** over unsupported and zirconia- supported **molybdenum carbide** catalysts)
- IT 1314-23-4, Zirconium oxide (ZrO₂), uses
(support; mechanistic difference between CO2 **reforming** of **methane** over unsupported and zirconia- supported **molybdenum carbide** catalysts)

L29 ANSWER 9 OF 27 HCA COPYRIGHT 2004 ACS on STN

137:81128 **Methane** dry **reforming** over carbide, nickel-based, and noble metal catalysts. Shamsi, Abolghasem (National Energy Technology Laboratory, U.S. Department of Energy, Morgantown, WV, 26507, USA). ACS Symposium Series, 809(CO2 Conversion and Utilization), 182-196 (English) 2002. CODEN: ACSMC8. ISSN: 0097-6156. Publisher: American Chemical Society.

AB Carbide catalysts of molybdenum and tungsten were prepd. and tested for reaction of methane with CO2 at atm. pressure. At this pressure the catalysts were not stable and the tungsten carbide irreversibly deactivated after 35 h on stream. The carbide catalysts produced lower H2/CO ratios at lower temps. of 650 and 750°C compared to noble metal or nickel-based catalysts. Tungsten carbide was partially oxidized to tungsten oxide during the reactions, resulting in lower catalytic activity. We also tested 1 wt% rhodium supported on alumina and two com. Ni-based catalysts, R-67 and G-56B. Significant amts. of carbon formed on the com. catalysts that plugged the reactor after 5 h on stream.

CC 51-4 (Fossil Fuels, Derivatives, and Related Products)

ST **methane reforming** catalyst synthesis gas

IT Reforming catalysts

Synthesis gas manufacturing

(dry **reforming** of **methane** with carbon dioxide over carbide and nickel-based and noble metal catalysts at atm. pressure)

IT 7440-44-0P, Carbon, preparation

(carbon formation on catalyst in dry **reforming** of **methane** with carbon dioxide over carbide and nickel-based and noble metal catalysts at atm. pressure)

IT 1344-28-1, Alumina, uses 7440-16-6, Rhodium, uses

(dry **reforming** of **methane** with carbon dioxide on rhodium-supported alumina catalysts at atm. pressure)

IT 7440-02-0, Nickel, uses 12070-12-1, Tungsten Carbide 12627-57-5, **Molybdenum Carbide**

(dry **reforming** of **methane** with carbon dioxide over carbide and nickel-based and noble metal catalysts at atm. pressure)

IT 74-82-8, **Methane**, reactions 124-38-9, Carbon dioxide, reactions

(dry **reforming** of **methane** with carbon dioxide over carbide and nickel-based and noble metal catalysts at atm. pressure)

L29 ANSWER 10 OF 27 HCA COPYRIGHT 2004 ACS on STN

136:265493 Alumina supported molybdenum-nickel carbides as catalysts for the dry **reforming** of **methane**.

Ferreira-Aparicio, P.; Menad, S.; Guerrero-Ruiz, A.;

Rodriguez-Ramos, I. (Instituto de Catalisis y Petroleoquimica. CSIC, Madrid, 28049, Spain). Studies in Surface Science and Catalysis, 138(Spillover and Mobility of Species on Solid Surfaces), 437-444 (English) 2001. CODEN: SSCTDM. ISSN: 0167-2991. Publisher: Elsevier Science B.V..

- AB Bimetallic molybdenum-nickel catalysts supported on alumina were studied in the carbon dioxide **reforming of methane**. Two different temp.-programmed redn. (TPR) pretreatments were followed for their synthesis: using hydrogen to obtain metallic molybdenum and using a CH₄-H₂ reactant mixt. to obtain **molybdenum carbides**, which have shown better performance in the reaction. Although in nickel catalysts the surface mobility of carbon species generated from methane decompn. leads to the accumulation of great amts. of carbon deposits in the support surface, the presence of molybdenum was obsd. to avoid these migration processes. The synergic effect found between both metals in Ni-Mo bimetallic samples reduces the temp. of carburization of molybdenum, improves its catalytic activity and its selectivity to hydrogen in the CH₄ + CO₂ reaction at the same time that avoids the formation of undesired carbon structures caused by methane decompn.
- CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
- ST molybdenum nickel carbide catalyst **methane reforming** carbon dioxide; carburization molybdenum nickel **methane reforming** carbon dioxide
- IT Carburizing
(of metals; alumina supported molybdenum-nickel carbides as catalysts for the dry **reforming of methane** with carbon dioxide)
- IT Synthesis gas manufacturing
(reforming synthesis gas manufg.; alumina supported molybdenum-nickel carbides as catalysts for the dry **reforming of methane** with carbon dioxide)
- IT 1344-28-1, Alumina, uses
(catalyst support; alumina supported molybdenum-nickel carbides as catalysts for the dry **reforming of methane** with carbon dioxide)
- IT 12627-57-5P, **Molybdenum carbide** 12710-36-0P, Nickel carbide
(catalyst; alumina supported molybdenum-nickel carbides as catalysts for the dry **reforming of methane** with carbon dioxide)
- IT 7439-98-7, Molybdenum, uses 7440-02-0, Nickel, uses
(catalysts; alumina supported molybdenum-nickel carbides as catalysts for the dry **reforming of methane** with carbon dioxide)

for **Methane Reforming** by TPR, XRD, and XPS. Oshikawa, Katsuhiko; Nagai, Masatoshi; Omi, Shinzo (Graduate School of Bio-Applications and Systems Engineering, Tokyo University of Agriculture and Technology, Koganei, Tokyo, 184-8588, Japan). Journal of Physical Chemistry B, 105(38), 9124-9131 (English) 2001. CODEN: JPCBFK. ISSN: 1089-5647. Publisher: American Chemical Society.

AB The relationship between various unsupported **molybdenum carbides** and their activity toward **methane reforming** at 973 K and 1 atm was studied. Unsupported **molybdenum carbides** catalyzed the formation of hydrogen in high selectivity, forming ethylene and ethane rather than benzene as the carbon-contg. products. η -Mo₃C₂, which was nitrified at 973 K and subsequently carbided at 1173 K, was more active than both α -MoCl-x and β -Mo₂C in methane decompn., forming hydrogen in high selectivity. α -MoCl-x and γ -Mo₂N were transformed to η -Mo₃C₂ in the bulk structure during **methane reforming** at 973 K. This transformation caused a significant increase in the turnover frequency of **methane reforming**. η -**molybdenum carbide** was also formed during CH₄-TPR of γ -Mo₂N at 788 K. The linear relationship between the amt. of η -carbide detd. through H₂-TPR of the catalysts and the methane disappearance rate revealed that η -Mo₃C₂ is the active species for **methane reforming**. From the XPS anal., Mo₀ was the dominant molybdenum species for the η -Mo₃C₂ catalysts.

IT 12122-48-4, **Molybdenum carbide Mo₃C₂**
(η -; characterization of **molybdenum carbides** for **methane reforming** by TPR, XRD, and XPS)

RN 12122-48-4 HCA

CN Molybdenum carbide (Mo₃C₂) (7CI, 8CI, 9CI) (CA INDEX NAME)

| Component | Ratio | Component Registry Number |
|-----------|-------|------------------------------|
| C | 2 | 7440-44-0 |
| Mo | 3 | 7439-98-7 |

CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 45, 49

ST **methane reforming catalyst molybdenum carbide**

IT Reforming catalysts
(characterization of **molybdenum carbides** for **methane reforming** by TPR, XRD, and XPS)

IT 7439-98-7, Molybdenum, uses

- (characterization of **molybdenum carbides** for **methane reforming** by TPR, XRD, and XPS)
- IT 71-43-2, Benzene, formation (nonpreparative)
(characterization of **molybdenum carbides** for **methane reforming** by TPR, XRD, and XPS)
- IT 74-82-8, Methane, reactions
(characterization of **molybdenum carbides** for **methane reforming** by TPR, XRD, and XPS)
- IT 74-84-0P, Ethane, preparation 74-85-1P, Ethylene, preparation
1333-74-0P, Hydrogen, preparation
(characterization of **molybdenum carbides** for **methane reforming** by TPR, XRD, and XPS)
- IT 12122-48-4, **Molybdenum carbide** Mo₃C₂
(η -; characterization of **molybdenum carbides** for **methane reforming** by TPR, XRD, and XPS)
- L29 ANSWER 12 OF 27 HCA COPYRIGHT 2004 ACS on STN
135:290995 Activity and Stability of **Molybdenum Carbide** as a Catalyst for CO₂ Reforming. Sehested, J.; Jacobsen, C. J. H.; Rokni, S.; Rostrup-Nielsen, J. R. (Haldor Topsoe A/S, DK-2800, Den.). Journal of Catalysis, 201(2), 206-212 (English) 2001. CODEN: JCTLA5. ISSN: 0021-9517. Publisher: Academic Press.
- AB The activity for CO₂ **reforming** of **methane** over a **Mo₂C** catalyst was studied at 8 and 1.6 bar total pressure using a plug flow reactor and a differential plug flow reactor with external recycle operated as a continuously stirred tank reactor (CSTR), resp. In the plug flow reactor, the catalyst deactivation started from the top of the reactor and proceeded downward, while it was stable in the CSTR at high conversions. Comparison of the activity of the **Mo₂C** with that of a 1.8% Ru/MgAl₂O₄ catalyst demonstrates that this noble metal catalyst is more than two orders of magnitude more active than the **Mo₂C** catalyst on the basis of wt. Thermodyn. calcns. of the stability of **Mo₂C** catalysts during CO₂ reforming conditions show that **Mo₂C** is only stable at high product concns. Finally, the carbon resistance of **Mo₂C** is calcd. to be higher than that of nickel-based catalysts. Carbon formation on a **Mo₂C** catalyst at 700°C requires an extra Gibbs-free energy of 4.5 kJ/mol compared to a nickel catalyst with nickel particles up to 2500 Å. (c) 2001 Academic Press.
- IT 12069-89-5, **Molybdenum carbide** **Mo₂C**
(activity and stability of **molybdenum carbide** as a catalyst for CO₂ reforming)
- RN 12069-89-5 HCA
CN **Molybdenum carbide** (**Mo₂C**) (8CI, 9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CC 51-11 (Fossil Fuels, Derivatives, and Related Products)

ST **methane** carbon dioxide **reforming** catalyst
synthesis gas

IT Synthesis gas manufacturing
(activity and stability of **molybdenum carbide**
as a catalyst for CO2 reforming)

IT **Reforming** catalysts
(for **methane**; activity and stability of
molybdenum carbide as a catalyst for CO2
reforming)

IT 12069-89-5, **Molybdenum carbide**
Mo2C

(activity and stability of **molybdenum carbide**
as a catalyst for CO2 reforming)

IT 74-82-8, **Methane**, processes 124-38-9, **Carbon dioxide**, processes
(activity and stability of **molybdenum carbide**
as a catalyst for CO2 reforming)

L29 ANSWER 13 OF 27 HCA COPYRIGHT 2004 ACS on STN

134:328766 Dry **reforming** of **methane** to synthesis gas
over supported **molybdenum carbide** catalysts.

Brungs, Attila J.; York, Andrew P. E.; Claridge, John B.;
Marquez-Alvarez, Carlos; Green, Malcolm L. H. (Wolfson Catalysis
Centre, Inorganic Chemistry Laboratory, University of Oxford,
Oxford, OX1 3QR, UK). Catalysis Letters, 70(3,4), 117-122 (English)
2000. CODEN: CALEER. ISSN: 1011-372X. Publisher: Baltzer Science
Publishers.

AB The dry **reforming** of **methane** at elevated
pressure over supported **molybdenum carbide**
catalysts, prep'd. from oxide precursors using ethane TPR, has been
studied. The relative stability of the catalysts in **Mo2C**
/**Al2O3** > **Mo2C**/**ZrO2** > **Mo2C**/**SiO2** > **Mo2C**
/**TiO2**, and calcination of the oxide precursor for short periods was
found to be beneficial to the catalyst stability. Although the
support appears to play no beneficial role in the **methane**
dry **reforming** reaction, the alumina-supported material was
stable for long periods of time; this may be important for the
prodn. of pelletized industrial catalysts. The evidence suggests
that the differences in the stabilities may be due to interaction at
the precursor stage between **MoO3** and the support, while catalyst
deactivation is due to oxidn. of the carbide to **MoO2**, which is
inactive for **methane** dry **reforming**.

IT 12069-89-5, **Molybdenum carbide** (
Mo2C)
(dry **reforming** of **methane** to synthesis gas
over supported **molybdenum carbide** catalysts)

RN 12069-89-5 HCA

- CN Molybdenum carbide (Mo₂C) (8CI, 9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
- CC 51-4 (Fossil Fuels, Derivatives, and Related Products)
- ST **reforming methane** synthesis gas
molybdenum carbide catalyst; alumina supported
molybdenum carbide catalyst dry **reforming methane**; zirconia supported **molybdenum carbide** catalyst dry **reforming methane**; silica supported **molybdenum carbide** catalyst dry **reforming methane**; titania supported **molybdenum carbide** catalyst dry **reforming methane**
- IT Catalyst supports
Petroleum **reforming**
Petroleum reforming catalysts
Synthesis gas manufacturing
(dry **reforming** of **methane** to synthesis gas over supported **molybdenum carbide** catalysts)
- IT 1314-23-4, Zirconia, uses 1344-28-1, Alumina, uses 7631-86-9, Silica, uses 13463-67-7, Titania, uses
(catalyst support; dry **reforming** of **methane** to synthesis gas over supported **molybdenum carbide** catalysts)
- IT 12069-89-5, Molybdenum carbide (Mo₂C)
(dry **reforming** of **methane** to synthesis gas over supported **molybdenum carbide** catalysts)
- IT 74-82-8, **Methane**, reactions
(dry **reforming** of **methane** to synthesis gas over supported **molybdenum carbide** catalysts)
- L29 ANSWER 14 OF 27 HCA COPYRIGHT 2004 ACS on STN
134:224911 Method of forming **molybdenum carbide** catalyst. Gao, Lin; Seegopaul, Purnesh (N.V. Union Miniere S.A., Belg.). U.S. US 6207609 B1 20010327, 3 pp. (English). CODEN: USXXAM. APPLICATION: US 1999-412175 19990930.
- AB A **molybdenum carbide** compd. is formed by reacting a molybdate with a mixt. of hydrogen and carbon monoxide. By heating the molybdate powder from a temp. below 300°. to max. temp. 850°, a controlled reaction can be conducted wherein **molybdenum carbide** is formed. A high surface area, nanograin, metastable **molybdenum carbide** can be formed when the reaction temp. is below 750°. The metastable **molybdenum carbide** is particularly suitable for use as a catalyst for the **methane dry reforming** reaction.
- IT 329722-20-5P, Molybdenum carbide (Mo₂C0.95-1.05)

(method of forming **molybdenum carbide**
catalyst for use in dry **reforming** of **methane**)

RN 329722-20-5 HCA

CN Molybdenum carbide (Mo₂C_{0.95-1.05}) (9CI) (CA INDEX NAME)

| Component | Ratio | Component Registry Number |
|-------------------|-------------|------------------------------|
| =====+=====+===== | | |
| C | 0.95 - 1.05 | 7440-44-0 |
| Mo | 2 | 7439-98-7 |

IC ICM B01J027-22

NCL 502177000

CC 51-5 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 67

ST **molybdenum carbide** catalyst manuf; synthesis gas
manufg catalyst

IT Synthesis gas manufacturing
(method of forming **molybdenum carbide**
catalyst for use in dry **reforming** of **methane**)

IT **329722-20-5P, Molybdenum carbide**
(Mo₂C_{0.95-1.05})

(method of forming **molybdenum carbide**
catalyst for use in dry **reforming** of **methane**)

IT 74-82-8, Methane, reactions 74-85-1, Ethylene, reactions
124-38-9, Carbon dioxide, reactions 630-08-0, Carbon monoxide,
reactions 1333-74-0, Hydrogen, reactions 11098-84-3, Ammonium
molybdate

(method of forming **molybdenum carbide**
catalyst for use in dry **reforming** of **methane**)

L29 ANSWER 15 OF 27 HCA COPYRIGHT 2004 ACS on STN

134:73796 Remarkable support effect of ZrO₂ upon the CO₂

reforming of **CH₄** over supported **molybdenum carbide** catalysts. Tsuji, Miyuki; Miyao, Toshihiro; Naito, Shuichi (Department of Applied Chemistry, Kanagawa University, Yokohama, 221-8686, Japan). Catalysis Letters, 69(3,4), 195-198 (English) 2000. CODEN: CALEER. ISSN: 1011-372X. Publisher: Baltzer Science Publishers.

AB In **reforming** of **CH₄** with CO₂ over **molybdenum carbide** catalysts, the catalytic performance of unsupported hexagonal **Mo₂C** prepd. by direct carburization of MoO₃ was considerably different from a similar compn., cubic MoCl_{1-x} (x ≈ 0.5), prepd. through nitriding before carburization. The conversion levels over MoCl_{1-x} were substantially higher than those over **Mo₂C**, although the turnover frequencies were lower. X-ray diffraction anal. indicated that **Mo₂C** deactivated by conversion to MoO₂ during the

reaction, but the MoCl-x was transformed to the hexagonal **Mo2C** and remained stable. The activity of **Mo2C** dispersed on various supports for the CH4-CO2 reaction was also investigated. The performance depended strongly on the property of supports, with the ZrO2-supported **Mo2C** catalyst exhibiting the highest activity and durability for this reaction. Moreover, deactivation of **Mo2C**/ZrO2 at ambient pressure was suppressed by decreasing the loading amt. of **Mo2C**.

IT 12069-89-5, **Molybdenum carbide**
Mo2C

(hexagonal/cubic; support effect of ZrO2 on CO2 **reforming** of CH4 over supported **molybdenum carbide** catalysts)

RN 12069-89-5 HCA

CN Molybdenum carbide (Mo2C) (8CI, 9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CC 51-11 (Fossil Fuels, Derivatives, and Related Products)

ST carbon dioxide **methane reforming** catalyst

IT Reforming catalysts

Synthesis gas manufacturing

(support effect of ZrO2 on CO2 **reforming** of CH4 over supported **molybdenum carbide** catalysts)

IT 12069-89-5, **Molybdenum carbide**
Mo2C

(hexagonal/cubic; support effect of ZrO2 on CO2 **reforming** of CH4 over supported **molybdenum carbide** catalysts)

IT 1314-23-4, Zirconia, uses

(support effect of ZrO2 on CO2 **reforming** of CH4 over supported **molybdenum carbide** catalysts)

IT 74-82-8, Methane, reactions 124-38-9, Carbon dioxide, reactions
(support effect of ZrO2 on CO2 **reforming** of CH4 over supported **molybdenum carbide** catalysts)

L29 ANSWER 16 OF 27 HCA COPYRIGHT 2004 ACS on STN

133:283843 Determination of reactive species for alumina-supported **molybdenum carbide** catalysts for **methane reforming** using temperature-programmed reaction methods.

Oshikawa, Katsuhiko; Nagai, Masatoshi; Omi, Shinzo (Graduate School of Bio-Applications and Systems Engineering, Tokyo University of Agriculture and Technology, Tokyo, 184-8588, Japan). Japanese Journal of Applied Physics, Part 1: Regular Papers, Short Notes & Review Papers, 39(7B), 4456-4459 (English) 2000. CODEN: JAPNDE. ISSN: 0021-4922. Publisher: Japan Society of Applied Physics.

AB The activities and surface properties of alumina-supported **molybdenum carbide** catalysts used in **methane reforming** were studied. Hydrogen, ethane, ethylene, and benzene were detected as the main products. The addn.

of oxygen effectively regenerated the catalyst. Temp.-programmed reaction expts. revealed that the surface **molybdenum carbide** species changes from β - **Mo₂C** to η -**Mo₃C₂**. The addn. of CO₂ to the feedstream reduced the formation of graphitic carbon on the catalyst surface, increasing the catalyst lifetime for benzene formation.

IT 12122-48-4, **Molybdenum carbide** (Mo₃C₂)
 (η -; detn. of reactive species for alumina-supported **molybdenum carbide** catalysts for **methane reforming** using temp.-programmed reaction methods)
 RN 12122-48-4 HCA
 CN Molybdenum carbide (Mo₃C₂) (7CI, 8CI, 9CI) (CA INDEX NAME)

| Component | Ratio | Component Registry Number |
|-----------|-------|------------------------------|
| ===== | ===== | ===== |
| C | 2 | 7440-44-0 |
| Mo | 3 | 7439-98-7 |

IT 12069-89-5, **Molybdenum carbide** (**Mo₂C**)
 (β -; detn. of reactive species for alumina-supported **molybdenum carbide** catalysts for **methane reforming** using temp.-programmed reaction methods)

RN 12069-89-5 HCA
 CN Molybdenum carbide (Mo₂C) (8CI, 9CI) (CA INDEX NAME)
 *** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
 CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
 Section cross-reference(s): 67

ST **methane reforming** catalysts **molybdenum carbide** reactive species

IT Reforming catalysts
 (detn. of reactive species for alumina-supported **molybdenum carbide** catalysts for **methane reforming** using temp.-programmed reaction methods)

IT 74-82-8, Methane, processes
 (detn. of reactive species for alumina-supported **molybdenum carbide** catalysts for **methane reforming** using temp.-programmed reaction methods)

IT 12122-48-4, **Molybdenum carbide** (Mo₃C₂)
 (η -; detn. of reactive species for alumina-supported **molybdenum carbide** catalysts for **methane reforming** using temp.-programmed reaction methods)

IT 12069-89-5, Molybdenum carbide (
Mo₂C)

(β -; detn. of reactive species for alumina-supported
molybdenum carbide catalysts for
methane reforming using temp.-programmed
reaction methods)

L29 ANSWER 17 OF 27 HCA COPYRIGHT 2004 ACS on STN

133:225302 Active species of **molybdenum carbide**

catalysts in **methane reforming**: η -Mo₃C₂.

Oshikawa, Katsuhiko; Nagai, Masatoshi; Omi, Shinzo (Graduate School
of Bio-applications and Systems Engineering, Tokyo University of
Agriculture and Technology, Tokyo, 184-8588, Japan). Chemistry
Letters (9), 1086-1087 (English) 2000. CODEN: CMLTAG. ISSN:
0366-7022. Publisher: Chemical Society of Japan.

AB Of three **molybdenum carbides** (α -
Mo₂C, β - Mo₂C, and η -Mo₃C₂), η -Mo₃C₂

was the most active **molybdenum carbide** species
for **methane reforming** (for benzene formation),
surpassing β - Mo₂C which has been reported previously.

From the correlation of the TPR results, the amt. of η -Mo₃C₂ was
directly related to the methane decompn. rate, indicating the
importance of this type of carbide for **methane**
reforming.

IT 12122-48-4, Molybdenum carbide (Mo₃C₂)

(catalysts; η -Mo₃C₂ catalysts as active Mo
carbide species in **methane reforming**
to benzene)

RN 12122-48-4 HCA

CN Molybdenum carbide (Mo₃C₂) (7CI, 8CI, 9CI) (CA INDEX NAME)

| Component | Ratio | Component Registry Number |
|-------------------|-------|------------------------------|
| =====+=====+===== | | |
| C | 2 | 7440-44-0 |
| Mo | 3 | 7439-98-7 |

CC 51-11 (Fossil Fuels, Derivatives, and Related Products)

ST **molybdenum carbide methane**
reforming benzene; aromatization methane benzene
molybdenum carbide

IT Petroleum refining catalysts

(aromatization; η -Mo₃C₂ catalysts as active Mo
carbide species in **methane reforming**
to benzene)

IT Carburizing

(of molybdenum surfaces; η -Mo₃C₂ catalysts as active
Mo **carbide** species in **methane**

- reforming to benzene)
- IT 12122-48-4, Molybdenum carbide (Mo_3C_2)
(catalysts; η - Mo_3C_2 catalysts as active Mo
carbide species in methane reforming
to benzene)
- IT 71-43-2, Benzene, formation (nonpreparative)
(formation of; η - Mo_3C_2 catalysts as active Mo
carbide species in methane reforming
to benzene)
- IT 74-82-8, Methane, reactions
(η - Mo_3C_2 catalysts as active Mo carbide
species in methane reforming to benzene)
- L29 ANSWER 18 OF 27 HCA COPYRIGHT 2004 ACS on STN
- 132:239196 Methane dry reforming over carbide,
Ni-based, and noble metal catalysts. Shamsi, Abolghasem; Lyons,
David (Federal Energy Technology Center, U.S. Department of Energy,
Morgantown, WV, 26505-0880, USA). Preprints - American Chemical
Society, Division of Petroleum Chemistry, 45(1), 132-134 (English)
2000. CODEN: ACPCAT. ISSN: 0569-3799. Publisher: American
Chemical Society, Division of Petroleum Chemistry.
- AB Molybdenum and tungsten carbide catalysts for methane
reforming with carbon dioxide deactivate after 35 h
onstream. They give a product with a lower H-CO ratio than a nickel
and a rhodium catalyst.
- IT 12069-89-5, Molybdenum carbide
mo2c
(methane dry reforming over carbide,
Ni-based, and noble metal catalysts)
- RN 12069-89-5 HCA
- CN Molybdenum carbide (Mo_2C) (8CI, 9CI) (CA INDEX NAME)
- *** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
- CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 67
- ST molybdenum tungsten carbide catalyst methane
reforming; carbon dioxide methane
reforming catalyst rhodium
- IT Reforming catalysts
(methane dry reforming over carbide,
Ni-based, and noble metal catalysts)
- IT Synthesis gas manufacturing
(reforming synthesis gas manufg.; methane dry
reforming over carbide, Ni-based, and noble metal
catalysts)
- IT 7440-02-0, Nickel, uses 7440-16-6, Rhodium, uses 11130-73-7,
Tungsten carbide 12069-89-5, Molybdenum
carbide mo2c
(methane dry reforming over carbide,

- Ni-based, and noble metal catalysts)
- IT 124-38-9, Carbon dioxide, uses
(methane dry reforming over carbide,
Ni-based, and noble metal catalysts)
- IT 74-82-8, Methane, processes
(methane dry reforming over carbide,
Ni-based, and noble metal catalysts)
- L29 ANSWER 19 OF 27 HCA COPYRIGHT 2004 ACS on STN
131:301243 Catalyst development for CO2 reforming of
methane under pressurized condition and the inhibition
mechanism of carbon deposition. Tomishige, Keiichi (The Univ.
Tokyo, Tokyo, 113-8656, Japan). Shokubai, 41(5), 336-337 (Japanese)
1999. CODEN: SHKUAJ. ISSN: 0559-8958. Publisher: Shokubai Gakkai.
- AB A review with 5 refs. Development of catalyst with high resistance
to carbon deposition in CO2 reforming of methane
under pressurized condition was carried out. It was reported that
the performance of β - Mo2C was comparable to that of
noble metal catalysts. Concept of catalyst function and the
mechanism of inhibition of carbon deposition are discussed.
- IT 12069-89-5, Molybdenum carbide (Mo2C)
(catalyst development for CO2 reforming of
methane under pressurized condition and the inhibition
mechanism of carbon deposition)
- RN 12069-89-5 HCA
CN Molybdenum carbide (Mo2C) (8CI, 9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
- CC 51-0 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 45, 67
- ST methane reforming catalyst carbon dioxide
pressurized review
- IT Reforming
Reforming catalysts
(catalyst development for CO2 reforming of
methane under pressurized condition and the inhibition
mechanism of carbon deposition)
- IT 12069-89-5, Molybdenum carbide (Mo2C)
(catalyst development for CO2 reforming of
methane under pressurized condition and the inhibition
mechanism of carbon deposition)
- IT 7440-44-0, Carbon, miscellaneous
(catalyst development for CO2 reforming of
methane under pressurized condition and the inhibition
mechanism of carbon deposition)
- IT 74-82-8, Methane, reactions 124-38-9, Carbon dioxide, reactions
(catalyst development for CO2 reforming of

methane under pressurized condition and the inhibition mechanism of carbon deposition)

L29 ANSWER 20 OF 27 HCA COPYRIGHT 2004 ACS on STN

131:288489 Magic catalysts. York, Andrew (Inorganic chemistry laboratory, University of Oxford, Oxford, OX1 3QR, UK). Chemistry in Britain, 35(8), 25-27 (English) 1999. CODEN: CHMBAY. ISSN: 0009-3106. Publisher: Royal Society of Chemistry.

AB A review, with 8 refs., of molybdenum and tungsten carbides as alternative catalysts to platinum and other Group VIII transition metals, focusing on their activity for hydrocarbons dehydrogenation, isomerization, hydrogenolysis, and **methane** partial oxidn. and **reforming** to synthesis gas. The potential application of the catalysts in petroleum refining, in decompn. of hydrazine, and use of oxycarbides as isomerization catalysts (e.g., for manufg. high-octane gasoline) were considered.

CC 51-0 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 45, 50, 67

IT **Reforming** catalysts
(for **methane** to synthesis gas; molybdenum and tungsten carbides)

IT 12070-12-1, Tungsten carbide 12627-57-5, **Molybdenum carbide** 142164-31-6, **Molybdenum carbide** oxide
(catalysts)

L29 ANSWER 21 OF 27 HCA COPYRIGHT 2004 ACS on STN

130:298976 Substitutes for precious metals in catalysis. Djega-Mariadassou, Gerald (Universite P and M Curie Laboratoire Reactivite de Surface et Structure, Paris, Fr.). Precious Metals, 21st, 377-386 (English) 1997. CODEN: PRCMEU. ISSN: 8756-0917. Publisher: International Precious Metals Institute.

AB A review, with 14 refs., discusses insertion of N or C atoms in the lattice of Mo and W which results in catalytic activity comparable to that of precious metals. Examples of applications (decompn. of hydrazine for satellite propulsion and conversion of methane to synthesis gas) are given.

IT 12069-89-5, **Molybdenum carbide** (**Mo₂C**)
(**reforming** of **methane** with carbon dioxide to synthesis gas)

RN 12069-89-5 HCA

CN Molybdenum carbide (Mo₂C) (8CI, 9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CC 51-0 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 50

IT Synthesis gas manufacturing
(**reforming** of **methane** with carbon dioxide to

- synthesis gas)
- IT 12069-89-5, **Molybdenum carbide (Mo2C)** 12070-12-1, Tungsten carbide WC
(**reforming of methane** with carbon dioxide to synthesis gas)
- L29 ANSWER 22 OF 27 HCA COPYRIGHT 2004 ACS on STN
130:225203 Comparison of the group V and VI transition metal carbides for **methane dry reforming** and thermodynamic prediction of their relative stabilities. Brungs, Attila J.; York, Andrew P. E.; Green, Malcolm L. H. (The Catalysis Centre, Inorganic Chemistry Laboratory, University of Oxford, Oxford, OX1 3QR, UK). Catalysis Letters, 57(1,2), 65-69 (English) 1999. CODEN: CALEER. ISSN: 1011-372X. Publisher: Baltzer Science Publishers.
- AB The group V and VI transition metal carbides have been prepd. by CH4 TPR, and tested for the dry **reforming of methane** with carbon dioxide, at elevated pressure. **Mo2C** and WC were the most stable catalysts, while the group V metal carbides showed the stability order: vanadium > niobium > tantalum. Catalyst deactivation was due to carbide oxidn. with CO2, while stability was assocd. with the reaction of metal oxide (from deactivation) with CH4, giving the metal carbide. Calcn. of the Gibbs free energy for this reaction resulted in a predicted catalyst stability trend similar to that obtained exptl.
- IT 12069-89-5, **Molybdenum carbide (Mo2C)**
(**methane dry reforming** and catalyst stability)
- RN 12069-89-5 HCA
CN Molybdenum carbide (Mo2C) (8CI, 9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
ST **methane** carbon dioxide **reforming** catalyst;
synthesis gas prepn **methane dry reforming**
- IT Transition metal carbides
(group V and VI; **methane dry reforming** and catalyst stability)
- IT **Reforming** catalysts
Synthesis gas manufacturing
(**methane dry reforming** and catalyst stability)
- IT 12069-89-5, **Molybdenum carbide (Mo2C)** 12070-12-1, Tungsten carbide WC 221128-02-5, Vanadium carbide (VC0.73-0.97) 221128-03-6, Niobium carbide (NbC0.7-0.99) 221128-05-8, Tantalum carbide (TaC0.7-0.99)
(**methane dry reforming** and catalyst stability)
- IT 74-82-8, **Methane**, processes 124-38-9, Carbon dioxide,

processes

(**methane** dry **reforming** and catalyst
stability)

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126:240510 Group (V) and (VI) transition metal carbides as new catalysts
for the **reforming** of **methane** to synthesis gas.

York, Andrew P. E.; Claridge, John B.; Marquez-Alvarez, Carlos;
Brungs, Attila J.; Green, Malcolm L. H. (Catalysis Centre, Inorganic
Chemistry Laboratory, University of Oxford, Oxford, OX1 3QR, UK).
Preprints of Papers - American Chemical Society, Division of Fuel
Chemistry, 42(2), 606-610 (English) 1997. CODEN: ACFPAI. ISSN:
0569-3772. Publisher: American Chemical Society, Division of Fuel
Chemistry.

AB High surface area group V and VI transition metal carbides,
synthesized by temp. programmed redn. of the metal oxides with
methane/hydrogen, have been tested as catalysts for the dry
reforming of **methane** with carbon dioxide and
partial oxidn. of methane with air. **Mo2C** and WC were
stable and highly active catalysts for these reactions at elevated
pressure, while they deactivated at ambient pressure. The product
distribution obtained was close to that predicted by the thermodyn.
equil., except that no carbon formation was obsd. on the catalyst
surface. The carbides of niobium and tantalum deactivated, even in
the dry reforming reaction at elevated pressure, due to their
greater tendency towards oxidn.

IT 12069-89-5, Molybdenum carbide (
Mo2C)

(catalysts,; for the **reforming** of **methane** to
synthesis gas)

RN 12069-89-5 HCA

CN Molybdenum carbide (**Mo2C**) (8CI, 9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 67

ST **methane reforming** catalyst molybdenum tungsten
carbide

IT Reforming catalysts

(molybdenum and tungsten carbides, for the **reforming** of
methane to synthesis gas)

IT 12069-89-5, Molybdenum carbide (
Mo2C)

12070-12-1, Tungsten carbide (WC)

(catalysts,; for the **reforming** of **methane** to
synthesis gas)

IT 1333-74-0P, Hydrogen, preparation

(manufg. of,; molybdenum and tungsten carbides catalysts for the
reforming of **methane** to synthesis gas)

IT 74-82-8, Methane, processes

(molybdenum and tungsten carbides, for the **reforming** of **methane** to synthesis gas)

L29 ANSWER 24 OF 27 HCA COPYRIGHT 2004 ACS on STN

120:79899 Preparation of oxide catalysts by reduction and partial carburization with reactive gases. Ledoux, Marc J.; Guille, Jean Louis; Panm Huu Cuong; Dunlop, Hugh; Prin, Marie (Pechiney Recherche, Fr.). Can. Pat. Appl. CA 2077316 AA 19930307, 17 pp. (French). CODEN: CPXXEB. APPLICATION: CA 1992-2077316 19920901. PRIORITY: FR 1991-12374 19910906.

AB Catalysts useful for (petro)chem. reactions, i.a. reforming, comprise cores of oxides of transition metals, rare earth metals, or actinides coated with mixts. of carbides and oxycarbides which are formed by redn. and carburization by the reactive gases. Reforming of a hexane-H mixt. over a MoO₃ catalyst at 350°/1 atm. (hexane partial pressure 5 mm Hg) gave a conversion of 70.00% with selectivity for C₆ hydrocarbons 80% after 53 h; vs. 3.16 and 59, resp., after 1.5 h.

IC ICM B01J023-00

ICS B01J037-12; B01J037-16; C10G035-06

CC 45-4 (Industrial Organic Chemicals, Leather, Fats, and Waxes)
Section cross-reference(s): 51, 67

ST reforming catalyst carbide oxide; molybdenum oxide carbide catalyst reforming; hexane reforming catalyst; **hydrocarbon reforming** catalyst; carburization oxide catalyst

IT 1313-27-5, Molybdenum trioxide, uses
(catalyst, carbide-coated, for **reforming** of **hydrocarbons**)

IT 12627-57-5, **Molybdenum carbide**
(oxide catalysts coated with, for **reforming** of **hydrocarbons**)

L29 ANSWER 25 OF 27 HCA COPYRIGHT 2004 ACS on STN

116:217659 Compared activities of platinum and high specific surface area **molybdenum carbide** (Mo₂C) and tungsten carbide (WC) catalysts for reforming reactions. I. Catalyst activation and stabilization: reaction of n-hexane. Ledoux, Marc J.; Huu, Cuong Pham; Guille, Jean; Dunlop, Hugh (Lab. Catal. Chim. Surf., Univ. Louis Pasteur, Strasbourg, 67000, Fr.). Journal of Catalysis, 134(2), 383-98 (English) 1992. CODEN: JCTLA5. ISSN: 0021-9517.

AB The catalytic properties of high sp. surface area (>150 m²/g) **Mo₂C** and WC are studied in **hydrocarbon reforming** and compared to conventional Al₂O₃-supported Pt. The isomerization of n-hexane is used as a test reaction. TPR and XPS analyses show that the raw materials are contaminated by O and need an activation. These analyses also show that **Mo₂C** is decompd. by pure H at 800° to form CH₄ and metallic Mo.

Different methods of reductive activation are tested: high-temp. redn. (800°) with H leads to metallic Mo and W on the surface (catalytically unreactive for reforming); coredn. by a mixt. of pentane and H (700°) gives active catalysts but less so than conventional Pt, probably because of the presence of carboneous residues formed by decompn. of n-pentane. Trace amts. of different group VIII transition metals (≤ 500 ppm) can catalyze the activation process, probably by preventing the formation of the carboneous residues. **Mo₂C** activated by 500 ppm of Pt, Ir, or Ru can reach total specific activities 6 to 7 times higher than the conventional Pt catalyst. However in terms of yield, the best carbide, activated by Ir, only doubles the performance of conventional Pt, with a high amt. of cracked mols. formed in parallel. Clean surfaces of **Mo₂C** or WC can be much more reactive than conventional Pt catalysts in terms of specific activity, isomerization, plus cracking; however, the best selectivity in isomers never exceeds 30% while selectivity on Pt is usually in the range 75-85%.

IT **12069-89-5, Molybdenum carbide (Mo₂C)**
(catalysts, for petroleum reforming, activation and stabilization of)

RN 12069-89-5 HCA

CN Molybdenum carbide (Mo₂C) (8CI, 9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CC 51-6 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 67

ST petroleum reforming catalyst **molybdenum carbide**;
tungsten carbide reforming catalyst

IT **12069-89-5, Molybdenum carbide (Mo₂C)** 12070-12-1, Tungsten carbide
(catalysts, for petroleum reforming, activation and stabilization of)

L29 ANSWER 26 OF 27 HCA COPYRIGHT 2004 ACS on STN

113:47219 Platinum and rhodium substitution by molybdenum and tungsten carbides for catalysis. Synthesis, activation, and uses. Ledoux, Marc J.; Pham Huu Cuong; Marin, Sophie; Weibel, Michel; Guille, Jean (Lab. Catal. Chim. Surf., Univ. Louis-Pasteur, Strasbourg, 67000, Fr.). Comptes Rendus de l'Academie des Sciences, Serie II: Mecanique, Physique, Chimie, Sciences de la Terre et de l'Univers, 310(6), 707-13 (French) 1990. CODEN: CRAMED. ISSN: 0764-4450.

AB The reaction of MoO₃ and WO₂ vapors on activated C generated carbides with surface areas of 100-400 m²/g. Upon handling in air, these carbides form an oxide coating. The activation of these materials consists in the redn. of these oxide phases to epitaxial carbides by light hydrocarbon/H mixts. Trace amts. of Group VIII metals improve the activation. These catalysts were tested in

hydrocarbon reforming reactions and in pollution control for auto emissions. The paper includes an abridged English version.

IT 12069-89-5P, **Molybdenum carbide**(
mo2c)

(catalysts, prepn. and activation of)

RN 12069-89-5 HCA

CN Molybdenum carbide (Mo2C) (8CI, 9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CC 67-1 (Catalysis, Reaction Kinetics, and Inorganic Reaction Mechanisms)

Section cross-reference(s): 45, 59

ST carbide molybdenum tungsten catalyst prepn; **hydrocarbon reforming** molybdenum tungsten carbide catalyst

IT 12069-89-5P, **Molybdenum carbide**(
mo2c) 12070-13-2P, Tungsten carbide(w2c)
(catalysts, prepn. and activation of)

L29 ANSWER 27 OF 27 HCA COPYRIGHT 2004 ACS on STN

102:9457 Reforming catalysts based on tungsten and **molybdenum carbides**, and their use. Leclercq, Lucien; Provost, Marcelle (Eurotungstene, Fr.). Eur. Pat. Appl. EP 120798 A1 19841003, 18 pp. DESIGNATED STATES: R: DE, GB, NL. (French). CODEN: EPXXDW. APPLICATION: EP 1984-420057 19840323. PRIORITY: FR 1983-5480 19830325.

AB Mixed Mo-W carbides, of general formula $(\text{MoxW}_{1-x})\text{yCz}$ ($0 < x < 1$, $1 \leq y \leq 2$, $0.8 \leq z \leq 1$) were prepd. and used without any support, supported by Al_2O_3 , or on activated C as petroleum refining catalysts. Thus, $\text{Al}_2(\text{SO}_4)_3 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 24\text{H}_2\text{O}$, ammonium paratungstate, and ammonium paramolybdate were melted together in a quartz dish and homogenized. The melt was heated to 670 K to obtain powd. Al_2O_3 contg. oxides of Mo and W. Redn. in H at 870 K and reaction with CO at 870-1270 K gave the Al_2O_3 -supported carbides. The catalyst was effective in reforming (dehydrogenation) of cyclohexane [110-82-7].

IC B01J027-22; C10G035-06

CC 51-6 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 67

IT 12070-12-1
(catalysts, contg. **molybdenum carbide**, for
hydrocarbon reforming)

IT 12627-57-5
(catalysts, contg. tungsten carbide, for **hydrocarbon reforming**)